THE

ELECTRICAL REVIEW.

VOL. LXI. OCTOBER 25, 1907. No. 1,561.

ELECTRICAL REVIEW.

Vol. LXI.] CONTENTS: October 25, 1907. [No. 1,561.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos. Holborn 933; Central 4425 (Editorial only).

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Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1908 EDITION

NOW IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ARTIFICIAL ILLUMINATION.

THE great danger about the new science of illumination is that the multitude of voices raised in professional pronouncement, with the ulterior object of constituting for each prophet a pretty little private practice, will ultimately get the subject into disrepute. Already the temptation among practical men is to argue that they got on very well with lighting their houses and chapels before all this attention began to be devoted to the high science of illumination, and they cannot, or will not, see why the old empirical rules should not be followed as before. It is high time, therefore, that such an article should appear as that in the *Engineering News* of America, on the "Fundamental Principles of Artificial Illumination," summarising a few rules of practice consistent with the fundamental idea of good lighting, which are entirely comprehensible to the average engineer.

The problems are briefly those of colour, direction of light, diffusion, use of shades and globes, and amount of light to be used. Other points are secondary, and should be relegated to private ponderings. As regards colour, yellows and oranges should predominate for private house lighting, although for general work a colour value resembling that of sunlight should be striven for. The light should be so directed that illuminants should not be in the ordinary field of vision, or at any rate, should be screened and shaded in the best way possible. Direct reflection from dead light-coloured surfaces, as well as from bright polished ones, should be avoided. Keep to the old familiar rule of passing the light obliquely over the left shoulder. Diffuse the light as much as possible up to, but not beyond, the point where the usual effects of gentle light and shade on surrounding objects are obtained. Study shades and globes from the point of view, not only of simple diffusion, but also of the redistribution of rays in useful directions. The literature on this subject is already immense and is growing weekly, so that this point need not be further insisted upon. The rules for the amount of light required can be boiled down to very simple terms. For brilliant interior lighting an illumination of $\frac{1}{2}$ candle-foot is convenient. Where economy is to be studied, and moderate effects are required, $\frac{1}{4}$ or $\frac{1}{8}$ candle-foot is enough for general lighting. For reading or similar employment, 1 to 4 candle-feet are necessary, this being a local illumination. For unusually brilliant effects, as in ball-rooms, 1 candle-foot is allowable. Drawing offices have a minimum of 5, and a maximum of 14 candle-feet; a candle-foot being the illumination derived from a source of 1 candle-power at one foot distance. The law of inverse squares, of course, has to be employed in computation. In interior lighting, reflection effects have to be allowed for, the practical results pointing to an increase of 50 per cent. on the direct illumination in rooms ordinarily furnished in light colours, no increase at all where the furniture and draperies are sombre, and as high as 150 per cent. where alabaster-finished ceilings, light tinted walls, ivory tinted woodwork, and a minimum of furniture, are used.

With such simple rules for guidance, the plain, unvarnished type of electrical engineer can go a long way towards designing his illumination so as to give good and scientific effects, and the higher flights of calculation and obfuscation may be, to a large degree, left to those who have a larger amount of spare time on their hands than the ordinary electrical contractor who is conducting a thriving business.

The Halifax Tramway Accident.

THE report of this accident will be found in another column. It differs from the general run of tramway accidents in having been caused by a car dropping back on a steep hill and getting out of control.

Such an accident is easily reconstructed. Let us take a purely hypothetical case. An early workmen's car is being driven along almost empty streets by a motorman who has done the same thing day after day. He is cold, he is hardly yet awake, he has a clear road, and sees no need for the alertness which must be his directly the streets begin to get busy. The rails are greasy, but not bad enough to cause slipping even while the car ascends the steepest hill on the route. Why not then light a surreptitious cigarette, or bury nose in can, or stand back against the door shuffling chilled feet while the car steadily eats up the hill with the controller handle full on, and the brake chain slack ?

The car is in the usual state of workmen's cars—full to the straps—the hill is rather more trying than usual, perhaps one of the motors is developing an earthed field or a defective commutator, perhaps the car circuit-breaker is set a trifle lightly, or a jumping trolley-pole has brought guard wires across the trolley wires on another part of the route. Whatever the cause, current is cut off from the climbing car with as little warning as that which precedes a flash of lightning. Before the motorman can drop his can, or get his hands out of his pockets and step forward to the brake handle, the stiff grade has stopped the car, and in no time it is running backwards.

Will the slack never take up ? will the brake shoes never bite ? The time wasted in giving a complete turn to the brake handle, and two or three ratchetings through 90° or so to put on pressure, has been enough to accelerate the car to 10 or 12 miles per hour. The wheels skid under the frantic pressure, the driver cannot drop sand behind the wheels, there is no sanding pedal on the conductor's platform, there is no time to screw down the track brake, and if there were, the blocks would never grip at the speed now attained, the electric brake is thrown to the emergency stop —nothing happens. A fearful thud and crash overhead signals the trolley standard being torn out of the car ; that puts an end to the last hope of reversing the motors, and all there is to do is to hold on in dumb, hopeless, helpless, expectant and brain-paralysed terror to the handle of the wheel brake, knowing that the only chance of getting the mastery is to release the brake, knowing that the chance has gone now that the speed has reached 30, 40, even 50 miles an hour ; knowing, too, that the nerve required to release the skidding wheels and to make the car run faster still for a moment, just on the chance that there will be time to put on the electric brake, is not given to one man in a hundred.

Pull then, pull on the brake, who knows that one, just one more notch on the ratchet may not, in some miraculous way, pull up the car before the terrific end arrives !

The conductor meanwhile has been tugging at the same brake at his end of the car with as little sense and as little effect ; but, what would you ? Is the man to stand there thinking only, thinking in a dull way of what will happen when the wheels strike the curve at the foot of the hill or the points at the loop halfway down ? The horror of impotence possesses him, for, half-trained as a driver, he knows that the means to do anything useful, anything that will not hamper the action of the driver himself, are not in his power.

A locked controller, an empty sand pedal hole and the hand brakes are all that he can command ; and, fired by the senseless hope that never leaves us, he, too, tugs at the unresponsive handle, damning the regulation that forbids him to do so.

The question for us is, Should these things be possible ? The answer should lie in the report of the sitting Committee, whose labours may God speed.

London Railways made in Germany.

VARIOUS rumours of an absurd character have been in circulation in Berlin, alleging the impending conversion to electric traction of the Berlin City and Circle railways—absurd because they are opposed to the facts as illustrated by the existing situation of affairs which was recently set forth in this journal, and which foreshadowed that no practical steps could be carried out for at least two years on account of the necessity for the approval of plans and estimates by the Railway Ministry and the Ministry of Finance, and, finally, the sanction of the necessary funds by the Prussian Parliament. On the basis of being premature, the reports are also ridiculed by the Berlin *Tageblatt*, which, however, contains an observation of particular interest to the British electrical engineering trade, and this explains the reference to the Berlin rumours by way of introduction to the brief statement of the German newspaper, which frequently either represents, or at all events secures, the opinions of leading electrical engineering circles in Berlin. Our contemporary states that the technical solution of electric railway working to-day lies in the single-phase system, refers to the work of transformation on the London Bridge-Victoria section of the Brighton and South Coast Railway, and remarks that this will not be the only local line to be converted to the single-phase method in London. The electrification, to use the popularly-accepted term, will be gradually extended, we are told, to the whole network of the London local railways. The hope will be reciprocated on this side of the English Channel, but when we are informed that "it remains to be seen to which firm the management of the reconstruction will be entrusted," we open our eyes with astonishment. The same observation as to the execution of the work is also applied to the possible future work of transformation in Berlin, coupled with the names of two well-known firms, and the inference to be drawn therefrom is that the future work in connection with the suburban railways in London is to be committed to German firms !

If the Berlin newspaper in the present instance reflects the views entertained in Berlin, it is well that British electrical engineering firms should have been given this timely intimation that they will have no part in the conversion to electric traction of the local lines of certain of the railways in the English metropolis. As the hopes of British electric railway engineers are mostly centred upon London as the particular field for development of this kind in the near future, on account of the magnitude of the traffic within the metropolitan area, is it conceivable that they will now retire from this special sphere of activity in favour of those who have apparently already in anticipation secured the work of transformation of such lines ?

Standardisation of Extra High Pressures.

AMERICAN practice in long overhead transmissions has so far advanced that the question of standardisation has already arisen. The American Institute of Electrical Engineers has issued a list of voltages recommended for such alternating-current circuits, and the voltages recommended as standards are 6,600, 11,000, 22,000, 33,000, 44,000, 66,000 and 88,000. This classification is the latest edition of a set of recommendations originally issued in 1899, in which the limit of pressure contemplated was 20,000, and again in 1902, when the highest pressure

mentioned was 60,000 volts. The enlargement of values sufficiently clearly indicates the increased scope of American transmissions in recent years.

Although there is no immediate probability of such very high pressures being adopted in English practice, save for the problematic outlet of main line railway electrification, it is interesting to note the reason for standardisation in such systems, given by Mr. Chas. F. Scott in the *Electric Journal*, as, in a smaller way, the same arguments may be applied to practice in this country. The chief mechanical difficulty in the adoption of the pressure absolutely adapted, as regards weight of copper in transmission and the cost of generating plant at the station, to any particular scheme, is the transformer. American practice largely fixes distribution pressure to factories and other power users at 2,200 volts, and for the sake of uniformity and interchangeability it is recommended that standard transformer ratios should be multiples by five or ten of this figure. Where slightly different ratios are used, it is, of course, possible to bring out tappings from the windings giving special voltages, but much confusion in designing offices, workshops and operation would be avoided, if engineers in charge of the construction of new plants would adhere to standard voltages.

Another point which arises is the fact, evidenced by the increasing scope of electric power supply companies in this country, that in process of time individual undertakings are often absorbed into one general scheme. Where either periodicity or voltage is not standard, this change, which is often undoubtedly beneficial in securing decreased working expenses, is saddled with such difficulties as to render the combination almost impracticable.

Berlin Labour Questions.

The agitation in the Berlin electrical engineering industry, to which reference was made in this journal a week or two ago, appears to affect a considerably larger section than is represented by the erectors, and to be zealously promoted by the Metal Workers' Union, which was defeated on the occasion of the great strike in Berlin two or three years ago. At a meeting of electrical workers held in the Germania Hall, loud complaints were made about the alleged embarrassing conditions at the works of one of the principal companies in the German capital. For instance, the workmen's dining room is said to consist of a cellar in which coal and coke are stored near the boiler for the central heating of the works. One store-room, which is called the "corpse chamber," is stated to be a completely dark room without windows, in which water constantly stands in rainy weather. Yet 100 workmen are employed in this room. The same room is used for the storage of a large quantity of spirits, benzine, varnish, &c., but there is no emergency exit—even from the spirits! The workmen declare that the air in these departments is injurious to health, and this explains why, in their opinion, 10 per cent. of all the workers therein employed are ill. A further complaint relates to the alleged defective aid rendered in case of accidents. The final result of the meeting was the adoption of a resolution deciding to strengthen the organisation of the workmen in order to be ready on a given opportunity to fight for the removal of the existing evils.

Copper.

The copper market continues in a depressed condition owing to the reluctance of the buyer to disturb the (to him) favourable tendency of the price. Messrs. Merton's circular for the 15th inst. shows a drop in visible supplies consequent on general inactivity, the return being 10,683 tons, as against 12,138 for the end of September. Afloat from Chile we have 1,000 tons, against 1,950 for mid-September, and from Australia 3,600, against 3,950. The reduction in stocks and supplies, however, is not such as materially to influence the market, which is waiting on the buyer.

THE MODERN THREE-WIRE CONTINUOUS-CURRENT SYSTEM.

By W. A. TOPPIN, A.M.I.E.E.

In looking through the latest tabulated details of central stations in Great Britain one is struck by the fact that the distribution of electricity by the three-wire continuous-current system is by far the most popular, and that alternating-current distribution is making little, if any, progress. We find that out of a total number of 428 central stations 280 distribute by means of the three-wire system, 81 stations by means of two-wire direct-current and only 67 give a purely alternating current supply. The majority of the stations mentioned as supplying two-wire direct-current will change over to the three-wire system as they increase in size.

The large towns that have been obliged to generate electricity at high pressure in order to economically supply the increasing demand in their suburbs have generated alternating-current, two or three-phase, and transformed down at sub-stations which supply local three-wire networks with direct-current.

The arrangements of the modern three-wire network are practically standardised. Feeders drawn through ducts terminate in feeder pillars placed above ground; the distributors, generally laid solid, are here connected to them either by links or fuses. The distributors are also interconnected at distribution pillars.

Practical experience shows that an absolute failure in the supply due to cable faults is exceedingly rare. Feeders, owing to their freedom from joints and any interference, very seldom cause trouble. Distributors are liable to earth leakages, but these do not interfere with the supply to any consumer unless there is a defect in his installation.

There is no tendency for the insulation of the neutral wire to break down as it is normally at earth potential. The negative live conductor is generally the one to break down, but even if it earths badly to a water main the normal pressure is maintained between the consumer's mains. If the cable actually burns through, energy is supplied from either end up to the fault in most cases and thus no consumers are inconvenienced.

It is very important that no large earth leakages should remain on the network for any considerable time, as the mains not faulty and all wiring and fittings connected to them are subjected to a pressure above earth more than the normal, and other faults may develop.

It is an easy matter to localise the fault to a particular feeder or distributor by splitting up the network at the various disconnecting pillars. To locate the exact place to start excavating for the fault, different methods have at various times been advocated, but most of these require elaborate instruments and the making of the mains dead during the tests.

The writer came across a reference to a new method of testing in the *Electrical Magazine*, described by L. R. Lee. A few actual experiences quickly brought conviction that this method was by far the simplest and quickest for leakage localisation. The only apparatus required is a voltmeter and a coil of lightly insulated small wire. The most suitable voltmeter is a very sensitive one, having two scales, one reading from ·01 to 1 volt and the other 1 to 100 volts. Connect one terminal of the voltmeter to as good an earth as can be obtained; there is generally a terminal connected to an earth plate in each feeder and distributing pillar. A water-pipe or even a gas-pipe has been found to give excellent results. The other terminal of the voltmeter is connected to a screwdriver or metal plate.

The earth in the vicinity of the fault is raised to a pressure above the normal, and it is this pressure that we desire to measure. The fault will be found immediately below the spot where the highest reading is obtained. As it is essential that the leakage should be taking place during the test, it is advisable to have four lamps in series across the outers with the middle point earthed; these can be connected up at the nearest pillar, and thus save the trouble of telephonic inquiries to the station. Two actual tests will be described as examples of two types of faults.

D

In the first case, there was a 6-ampere leakage on a distributor, 400 yards long, laid in a trough filled with bitumen. In fig. 1 this cable is shown with its branches, and the voltages are marked at the points where they were obtained.

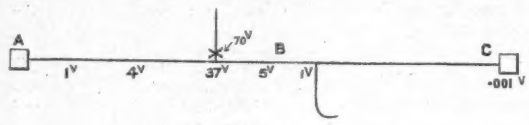


Fig. 1.

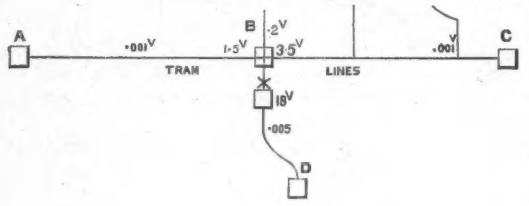


Fig. 2.

Taking three rough tests at A, B and C, it was apparent that the leakage was between A and B. Connecting up the voltmeter at A to the earth terminal in the pillar, and running out the coil of wire, readings were taken every few yards by putting the point of the screw-driver in between the flags of the pavement. The spot X was found to give the highest reading, and the two branch cables were found to be nearly burnt through immediately below it. There had been a leakage between the live and neutral cables, besides a leakage to earth from the live cable.

This test was made on a hot summer day, with the earth as dry and hard as it could possibly be. In the second case, shown in fig. 2, the faulty distributor was over 800 yards long, laid in a variety of ways, and was running parallel with a tramway. The earth leakage was about 20 amperes, and the voltage of each live cable was measured to earth. The positive cable was found to be 490 volts above earth, and the negative, 32 volts below earth. Gas pipes were the only available earth connections; the tramway rails caused the surrounding earth to be at varying pressures according to the traction load, and altogether the conditions were unfavourable.

Taking three rough tests at A, B and C, the highest reading was obtained at B, and the four branches from this box were tested with the results shown. The branch cable to D was drawn through iron pipes under the street, and at X the negative cable was found welded to the iron pipe a short distance from the street box. A reading of 18 volts was obtained from the cover of this box. The above tests were carried out in a very short space of time.

The great feature of this simple method of testing is that there is no interruption to the supply to consumers. The latter must be made to feel that they can place as much reliance on electric light as they have hitherto on gas. Any improvement that tends towards reliability of supply should therefore be made as widely known as possible. Street box covers hurled into the air, and consumers groping about with their premises feebly illuminated by candles stuck in bottles, are not events likely to popularise the use of electricity.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Slate Switchboard Panels.

I have at various different times experienced considerable trouble with switchboards having as bases enamelled slates, due to the fact that at the negative pole of fittings (where both poles are on one base) moisture collects and shows its presence in two ways:—

1. It raises blisters in the enamel, which, on being cracked, show a clear liquid; and
2. It seriously corrodes the negative terminals where this liquid collects.

I have no doubt that many of your readers have experienced the same trouble. If they have, I shall be obliged if they will be good enough to reply to this, stating, if possible, the cause of the trouble, and also a possible inexpensive cure. I don't think that this trouble is experienced when the switchboard base is of marble.

Werdna.

October 18th, 1907.

[For any but low voltages, slate switchboard panels should always be bushed with ebonite or other suitable insulator where terminals, &c., pass through. The cause is the inefficiency of the slate as an insulator, it being common knowledge that moisture and salts collect at a leaky negative terminal.—Eds. Elec. Rev.]

Testing the Insulation of D.C. Networks.

In your issue of October 18th, Mr. F. Charles Raphael has shown that, by suitable substitutions in formula (1) of my article on the above subject, it may be made to assume the form—

$$\frac{C_1 - D_0}{2D_2 - C_1} R_1,$$

which, he states, is the same as formula (17) on pages 43 and 48 of the second edition of his book. This being so, he infers that my formula is virtually the same as his own. But, I ask, is this inference really logical? If it is, we may surely apply the criterion of substitution to other tests which are made between any one bus-bar and earth. Take, for example, "Russell's test," which is described on page 46 of Mr. Raphael's work, and which may be written $\frac{V_1 - V_2}{C_1}$, or its equivalent, $\frac{V_1 - C_1 R_1}{C_1}$; where

V_1 = the D.P. between any main and earth, without, and
V_2 = the D.P. between the same main and earth, with, an earth connection of R_1 ohms, and
C_1 = the current flowing in the earth connection.

If a voltmeter of R_2 ohms resistance be employed to obtain the voltage of the main to earth before the earth connection is made, it will indicate $V_1 - C_2 x = C_2 R_2$ volts, where C_2 is the current passing through the voltmeter, and x is the insulation of the network to earth. Therefore, $V_1 = C_2 x + C_2 R_2$. When the earth connection of R_1 ohms is made, the current through it will be—

$$C_1 = \frac{C_2 x + C_2 R_2}{x + R_1},$$

from which

$$x = \frac{C_1 R_1 - C_2 R_2}{C_2 - C_1}.$$

That is formula (1) of my article. In the case where a static voltmeter is employed, $C_2 = 0$, and the formula becomes—

$$\frac{V_1 - C_1 R_1}{C_1}.$$

May I infer from this that Mr. Raphael's "shunted ammeter" method is virtually the same as "Russell's test?" I think not.

Does not, rather, the relationship existing between these formulæ indicate the existence of a law underlying them? Or, to put it another way, Are not these formulæ "different angles" at which we survey a central "truth"?

Daniel Shirt.

Birmingham, *October 19th*, 1907.

Mr. Daniel Shirt has been good enough to send me a copy of the letter he has sent you, and I add my hearty agreement with the last sentence of his letter. If all mains engineers were to study the question of insulation testing in so thorough a manner as he, there would be far fewer cases of mains breakdown. The fact that Mr. Shirt has deduced his formula from first principles, instead of taking the short

cut of deducing it from the one that I had evolved by the same laborious process, shows that he is thoroughly conversant with the subject.

F. Charles Raphael.

London, E.C., *October* 21*st*, 1907.

[The underlying law, and the central truth, is simply E = C R !—Eds. E.R.]

Publicitis.

In your last issue an article appeared containing four imaginary letters from a supply company's engineer to a prospective consumer.

As an example that "fact is stranger than fiction," the enclosed cutting from a provincial contemporary is hard to beat.

S. A. Lorick.

London, N., *October* 21*st*, 1907.

FOLLY OR IGNORANCE.—The Corporation or their officials are doing their best to bring to notice the advantages of electric lights, and I do not blame them. But would it not be advisable to have their advertisements edited a little, so that they may not lay themselves open to the charge of folly or ignorance. Here is an extract from an advertising letter sent by the chief engineer to the manager of a public house:—

"The many advantages of electric light are no doubt known to you, but have you realised how much more attractive an installation would make your business premises? The coolness in *the hot summer evenings*—impossible with any other method of lighting—will gain the immediate appreciation of your present customers, and many new ones also. The freshness of the atmosphere thereby ensured, prevents that feeling of stupor often seen in people coming suddenly from a stifling atmosphere into the fresh air outside, *an effect which is so often mistaken as being due to intoxicants. In this way electric light would be of the greatest assistance in maintaining unsullied the good reputation of your house.*"

The italics are mine. I have read many letters worthy of Bumbledom; never a letter such as this. It is either ignorant, or foolish or insolent. Just think of the chief engineer taking upon himself to provide means to keep unsullied the reputation of a public house! As if the reputation of the house had not been established for years, and required the help of officious meddlers!

Long Wheel Base Trucks.

Mr. Warner in his hurry to put Mr. Mozley right with reference to differential axles for tramway trucks, states that Mr. McLaren not only constructed radial trucks with differential drive, but he also equipped electrical motors on radial trucks, and refers to a patent taken out by Mr. McLaren in 1892. As a matter of fact, this specification refers to a locomotive of the Bissell type, one paragraph therein only vaguely referring to electric traction without any drawing or details showing how the arrangement should be carried out. As a fact, however, no such trucks were ever put into use, and the patent at the end of the first period became void.

Under these circumstances, I fail to understand the grounds on which Mr. Warner bases his statements.

I was the first to invent a workable and practical radial truck which really answered the purpose for which it was invented. This was done in July, 1903, in Birmingham; and before it was put on the market it was thoroughly tested and examined by many eminent engineers who expressed themselves as satisfied with its performance.

Large numbers of these trucks have been made to my specification, and upwards of 100 have for the past three years been running in Birmingham alone.

Geo. Conaty.

Birmingham, *October* 21*st*, 1907.

Seeing Mr. Warner's signature in last week's issue, I looked forward to some further information from his own experience, knowing that he has investigated this matter for some years, but I was disappointed.

In the first place he misquotes my paper, which stated that "While the flange wear may be reduced (accepting Mr. Warner's statement that such is the case), the constant grinding slip on the rail head will be increased."

Mr. Warner's statement that he also decreases the wear on the tire tread will be more acceptable if he will explain how an axle with two rigid wheels fixed to it, and which he states is never parallel to the other axle, can constantly be changing its angle relative to the track without increasing the grinding slip on the rail head.

He also wants to know how it is possible to increase tire-tread wear without increasing flange wear. Both long and short wheel-base trucks will, under certain conditions, run their tires right down and still have a complete flange, therefore, to decrease or increase the diametrical wear *only*, one must put on or take off Mr. Warner's link suspension. He is here questioning his own claims.

He complains of "mere casual surmises when precise unanswerable facts are available," and then tells us one of his trucks has "run for about two years." "Precise facts," please, Mr. Warner—dates and car-mileage.

The figure he gives of the difference in tire diameter is also a subject for further investigation, as on an ordinary car differences in the diameter of wheels on either axle may be as much as $\frac{3}{16}$ in. when they are worn down.

The suggestion that my opinions were "made in Germany" is unfortunate, as they were in print before I visited that country.

I can, however, assure Mr. Warner that my friends in Nuremburg were much interested in his suspension, not having seen it before, particularly as it is somewhat on the same lines as the long wheel base cars running in Nuremburg, Vienna, and Buda-Pesth, one of the chief differences being that Mr. Warner controls the movement of his axle box solely by the vertical downward thrust of the car body, whereas on the Continental trucks the movement is restricted by the suspension links being at an angle, and it is further curtailed by the small clearance allowed between the axle box and horn plates.

Mr. Warner, on the one hand, advocates perfectly free axles, whereas English experience generally shows the necessity of very heavy axle control springs on the ordinary radial truck, and also that good results can be obtained by locking both the inner trucks on an 8 ft. 6 in. wheel base.

Continental practice points in the same direction, as there they have found the necessity of restricting the clearance between the axle box and truck frame to a minimum. Experience and statements in figures will show which system is to survive, and those that are investigating the subject cannot do better than equip a truck with the gear devised by Mr. Warner, to whom the thanks of all tramway managers are due for his valuable work in this direction.

R. L. Acland.

Chesterfield, *October* 21*st*, 1907.

"How it was Done."

I am somewhat surprised at the lack of enterprise displayed by the Electrical Review and its contemporaries in the matter of the opening of the Atlantic wireless service. Failing the technical journals, I have had to consult the *Daily Mail*, not only for details of the actual results obtained, but for an explanation of how the Marconi system works.

Possibly some of your readers may not have been fortunate enough to see last Friday's issue of that paper, and others, perhaps, may not have been able to follow the somewhat intricate technical description. With your permission, therefore, I would like to call attention to one or two points which are doubtless of prime importance, but which I do not remember to have seen mentioned elsewhere.

First, as to the method of manipulating the sending key. The operator "dressed in mufti and wearing a soft hat of grey felt," should be "seated on a plain wooden chair on a dais about a foot above the ground."

I imagine that these precautions are necessary as a protection against shocks. The use of mufti is easily understood; a uniform loaded with gold lace would be very inadvisable, since the current instead of "spinning up into the connection room above" might prefer to find a short cut to earth.

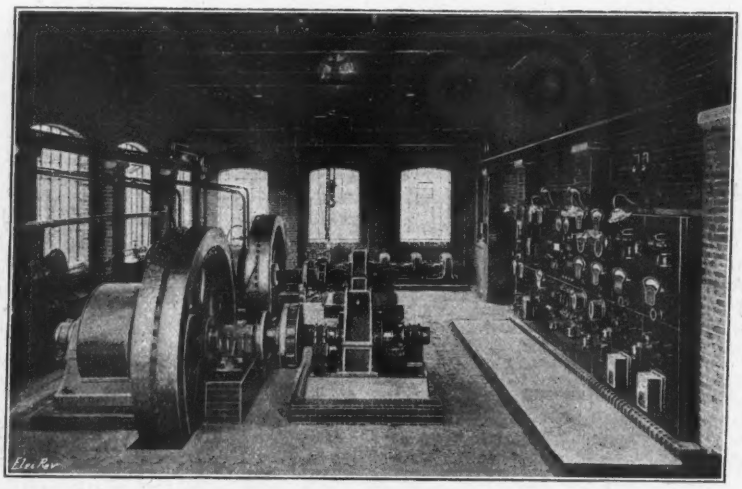
I am a little surprised, personally, at the meagreness of the seating accommodation provided for the operator. One would have expected him to be perched, Simon Stylites fashion, on a pillar of solid ebonite. But a "plain wooden chair" on a dais merely 12 in. high seems too paltry.

No attempt was made to signal until 11.49 (Irish time). For some time previously the dynamos had been "driving a high-pressure current into the electrical apparatus of the

condenser house." No expense was to be spared; a typewritten sheet containing the *Daily Mail* marconigram lay on the bench before the operator; his fingers itched to tap the key and produce those lovely "rasping booms,"

Ascot Electricity Supply: The Gas Co.'s New Generating Station.

but no! Orders were orders, and until there was a sufficient accumulation of current in the condenser house, the man on whom the eyes of two continents were focussed had to possess his soul and his grey felt hat in patience. One could tell by the loud humming monotone that the current was "ramifying," one could see in imagination the electricity lying in thick layers on the condenser plates. At last all was ready, one glance at the "three pressure or current indicators" told that the current was sufficiently "ramified," and the order was given to "stand-by."



Ascot Electricity Supply: View in the Engine Room.

It was a thrilling moment; the operator had at his right elbow a tramcar controller, with which presumably he could at will put the sending key in parallel with the dynamos, or the receiver in series with the spark gap. No details, unfortunately, are given, we are merely told that he "swiftly moved the crank a button or two."

The operator's "sending fingers" hovered for a moment in the air and then descended on the key. How touching. No doubt tears of triumph sprang to his eyes which he wiped away with his unoccupied receiving fingers. But in the meantime the discharger was booming like mad, and the currents were spinning "through a mesh of hair-like wires."

What price cables now? "The operator, shrugging his unconcern, began to send another message."

Walter Claypoole.

London, S.W., *October 22nd*, 1907.

Bayonet Caps for Lamps.—The makers' names are asked for.

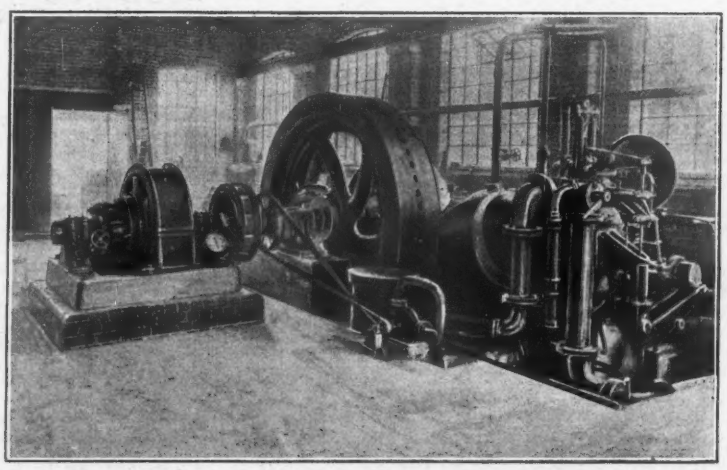
ELECTRICAL DEVELOPMENTS AT ASCOT.

Ascot was the scene of an interesting ceremony on Tuesday afternoon last, when Sir Walter Palmer, Bart, opened the new electricity station erected at the works of the Ascot District Gas and Electricity Co. In itself, the function was of short duration, Sir Walter simply starting the engines and then switching on the current.

After the plant had been thoroughly inspected, a number of those present were entertained to dinner by the chairman and directors of the company, Sir Walter Palmer occupying the chair. Here the usual toasts were given and responded to, success to the new undertaking being the underlying sentiment expressed or implied in most of what was said.

Formed in 1882, the Ascot District Gas Co. started with a capital of £60,000, and recent balance-sheets show that 5½ per cent. has been paid upon the ordinary shares. In 1906, the company applied for and obtained Parliamentary powers to supply electricity in what might be termed the Ascot area, although, as a matter of fact, Chobham, Sunninghill, Sunningdale, Bracknell, Windlesham, Bagshot and Winkfield are amongst the parishes covered by the powers granted, some of the places named being in the County of Surrey and others in Berkshire. To carry out this scheme, the directors were empowered to raise an additional £30,000, in share capital, thus bringing the entire capital of the company up to £90,000. In connection with these details it may be mentioned, that this is the first gas company in England to put into actual operation powers granted for the supply of electricity. Other gas companies have obtained the powers, but have either disposed of them or have failed for some reason or the other to put them into effect.

That this venture will meet with the due appreciation it deserves and that, before long, it will bring in a satisfactory return to the promoters, may almost be taken for granted, as, hitherto, many of the influential residents in the district have installed their own private electrical plants.



Ascot Electricity Supply: Hornsby-Johnson & Phillips Generating Plant.

The generating plant consists of two Hornsby-Stockport 90 B.H.P. horizontal suction gas engines, each coupled through a flexible coupling to a Johnson & Phillips D.C. generator, capable of giving nominally 110 amperes at 460 volts, when running at 210 R.P.M. The engines are fitted with Simms-Bosch electric ignition, and are

started by means of compressed air at 100 lb. pressure, supplied by a motor-driven air compressor; a stand-by petrol hand starter is also provided, and hand barring gear. To minimise noise, the exhaust from engines is led through six cast-iron boxes into a brick pit filled with clinkers.

Gas is supplied by a Hornsby-Stockport producer with the usual cleaning and scrubbing plant, the producer having in addition to the ordinary hand fan, a small electrically driven blower; the hand-blower is used merely as a stand-by. Coke from the adjoining gas works is used for fuel. There is only one gas producer, but a branch pipe from the lighting gas main is run through a meter into the engine room with a view to providing an emergency supply.

A semi-automatic balancer booster is provided for working in conjunction with a battery. Each booster gives 100 amperes at any voltage from 10 to 90. The shunts of the balancers are cross-connected, and the boosters are of the reversing type with diverter coils and rheostats.

The battery consists of 240 Tudor cells, capable of discharging at 54 amperes for 10 hours, with a maximum discharge of 140 amperes for three hours; all the cells are arranged on one tier only.

The main switchboard is installed on the wall, between the engine and battery rooms; a brick chamber behind gives ample access to the connections. The accumulator regulating switches are mounted on the wall of this chamber, in the battery room, and are actuated by spindles and hand-wheels on the main board, thus keeping all the battery connections in the cell room. The switchboard contains dynamo, battery, feeder and middle-wire panels, the instruments being of the moving-coil type, supplied by Messrs. Everett, Edgcumbe, with the exception of the feeder voltmeters, which were made by Messrs. Nalder Bros. & Thompson, to the engineers' designs. These, in addition to showing the voltage at the ends of the feeders, have an attachment by means of which an electric bell rings when the voltage rises or falls below a predetermined amount. This plan, adopted by the engineers in several stations, is exceedingly convenient in the smaller stations, as it obviates, with the assistance of the automatic booster, the necessity of constant attention to the switchboard.

At the present time some seven miles of mains, consisting of three-core paper-insulated lead-covered cable, have been laid by Messrs. Siemens Bros., on the solid system in tarred wooden troughing. All services and straight-through joints are lead wiped, and wiped joints are made on to the three and four-way disconnecting boxes, the earthing of the lead sheathing being thus continuous throughout. Two sizes of distributor cables only are used—viz., ·1 × ·1 × ·1 sq. in. and ·05 × ·05 × ·05 sq. in.

Water for the gas plant and for the water circulation of the engines is stored in a tank of 8,000 gallons capacity, a small centrifugal pump on each engine assisting the circulation. A plentiful supply of water is obtained either from the local company's mains or from a deep well on the premises. The tank, which is mounted on iron columns, forms a roof over the gas producer.

The plant is housed in a substantial red brick building provided with a 10-ton travelling crane in the engine room.

The engineers for the scheme, Messrs. Handcock & Dykes, have been particularly successful in planning a scheme well suited to the district wherein it will operate, and they are to be congratulated upon the result achieved.

As the contracts were not given out until the beginning of May last, the time taken in erecting the station and laying the mains has been only five months.

The contractors were as follows:—

Gas plant, dynamos, water tank, piping, &c.—Messrs. Bilbie, Hobson & Co. (Messrs. Hornsby & Sons, Ltd.).
Accumulators.—The Tudor Accumulator Co.
Switchboard, boosters and connections.—Electric Construction Co.
Overhead crane.—Messrs. Herbert Morris & Bastert.
Underground mains, meters and services.—Messrs. Siemens Bros. and Co.
Station wiring.—Messrs. Tyler & Freeman.

The last-named firm exhibited a variety of electrical apparatus in operation at the works, for the edification of the visitors.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Hutchison Acousticon.

Three sets of "Acousticon" apparatus, a trans-Atlantic invention for aiding defective hearing, have been supplied recently for the use of Her Majesty Queen Alexandra. The Acousticon is the invention of Mr. Miller R. Hutchison, and in any of its varied forms it comprises a telephone transmitter and receiver, a battery, and suitable switching devices, as shown in fig. 1 (the most portable form of the apparatus), the battery being concealed in one's pocket or satchel.

Fig. 2 shows the Acousticon made up in a form resembling a small hand-camera, when the box can be placed either on a table, on a reading-desk in a church pulpit, or near the footlights in a theatre, in which events all sounds uttered within 50 ft. are picked up by the transmitter and can be telephonically conveyed directly to the ear of a deaf person at any part of an auditorium, or, if switched on to an ordinarily good telephone circuit, can be carried a considerable distance.

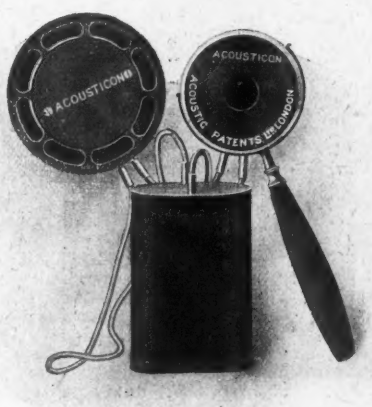


Fig. 1.

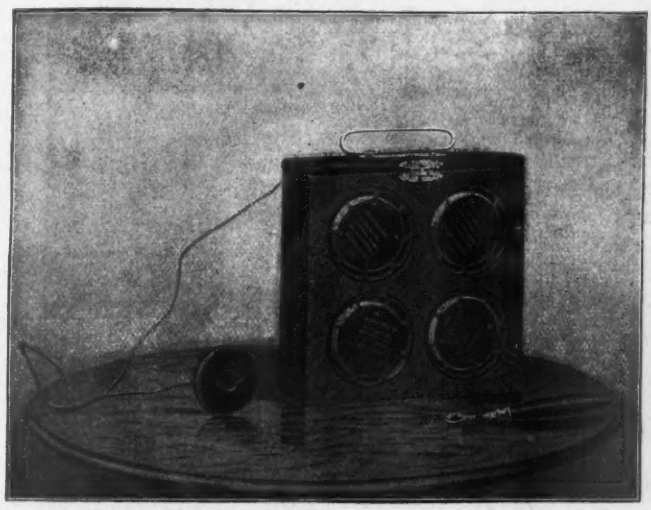


Fig. 2.

The Hutchinson Acousticon.

The cardinal principle of the Acousticon is that it applies a scientifically constructed ear-trumpet directly to a highly sensitive telephone transmitter. This trumpet, which the inventor calls an "ear-funnel," is the result of countless experiments to secure a device modelled on the fashion of the human ear, and scientifically adjusted to collect and reflect sounds with the maximum intensity. In combination with the microphonic transmitter, it has the capacity of transposing sound vibrations, so that the softer sounds of the voice are intensified, and the louder modulated. As long as the faculty of hearing is not destroyed or paralysed, audible speech or music can be transposed into any higher "key" to suit the individual ear. The sensitiveness of the instrument is secured by adjusting the tone of each receiver to the respective transmitter; while the granulated carbon used in the transmitter is in the form of minute polished hollow balls. A small Danish dry battery supplies the necessary current.

The Acousticon has been supplied to a number of churches and theatres in the United States, and has recently been installed at the Church of the Holy Trinity at Tunbridge Wells. As many as fifty receivers can be connected up at the same time with one of the larger transmitters. Usually a deaf person will take his own receiver to a church or theatre and switch himself on to the Acousticon circuit at his seat. By the use of the instrument a deaf person can hear all the ordinary conversation in a room. Deaf persons can converse with each other, the ordinary speaking voice not having to be raised.

An amplified form of the Acousticon, known as the "Dictophone," enables ordinary conversation to be transmitted from room to room with or without the aid of receivers; and Mr. Hutchison has

recently produced an automobile horn operated magnetically on touching a button, which applies the fundamental principle of his invention to a modified megaphone.

Hollick's Patent Motor for High-Speed Crane Work.

This motor (see fig. 3) has been designed for crane work in which quick operation is necessary. The magnets are mounted so that they are free to revolve about the armature, the armature being also free to revolve. The end plate carrying the magnets has a hollow bearing which runs on the pedestal and projects through it. On the projecting end a bevel-wheel is fixed, the armature spindle passing through the centre; this also has a bevel-wheel fixed upon it. These two wheels have two idle bevel-wheels gearing with them, which are mounted in a casing. The outer end of the armature spindle is provided with a brake wheel; and the magnet casing and the casing surrounding the bevel wheel form brake-wheels.

It will be seen that if the brake wheel on the casing surrounding the bevel gear is held and the motor is switched on, the armature will revolve in one direction and the magnets in the opposite, the casing over the bevel gear remaining stationary. In this position, armature and magnets are revolving at half the speed they would be if either were held, but relatively their speed is always the same. If the brake on the casing surrounding the bevel-wheels is released, and the brake on the magnet shell is held, and the brake on the armature spindle is off, then the armature spindle will be going at full speed in one direction, the magnets will be stationary, and the casing surrounding the bevel gear will be running at half the speed of the armature spindle and in the same direction. If now the magnet brake is released, the armature brake put on, and the brake on the casing kept released, the armature will be stationary, the magnets will be revolving at full speed—viz.: the same speed as the armature did previously, but in the opposite direction—and the casing surrounding the bevel gear will be revolving at half the speed of the magnets and in the same direction. In Mr. Hollick's arrangement the drive is taken from the casing surrounding the bevel gear, and it is obvious that by connecting the three brakes described above to one lever, so that they can be easily operated, a quick reversing motor is obtained without the relative speed of the armature and magnets being altered, at the same time the starting in either direction, although very quick, is most gentle, as is borne out by current readings. The motor is switched on by the ordinary starter, and it is then running just as a shunt-wound motor at constant speed, after which the operation of the brakes for running in either direction will not cause the current to jump above the normal load current when operating one load per minute from ship to barge, involving four reversals, that is, 240 reversals per hour. This arrangement has also another advantage in crane work, viz., that if the motor is rated to run at 500 revolutions per minute in the ordinary way, it will give a speed of only 250 revolutions per minute on the casing surrounding the bevel gearing.

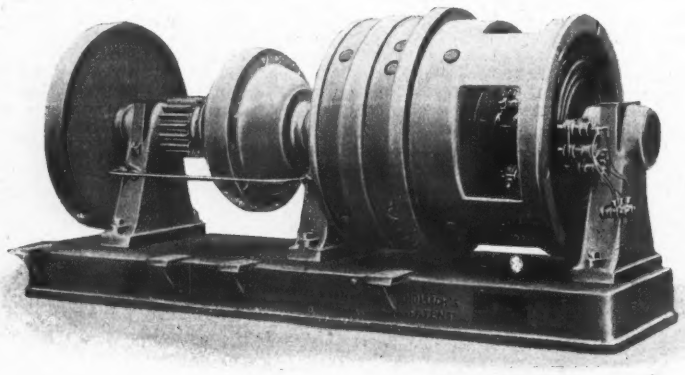


Fig. 3.—Hollick's Crane Motor.

Messrs Samuel Williams & Sons, Ltd., of Dagenham Dock, have had eight cranes operated by such motors for some years with the best results. These cranes are used for discharging coal from ships into barges by operated grabs, and in order to economise in the size of motors, it was found desirable to counterbalance the weight of the grabs; this involves the quick reversing motor, and, as is well known, coaling work has to be done quickly.

These motors, which are the patent of Mr. T. D. Hollick, of Messrs. Samuel Williams & Sons, Ltd., were designed to meet the exigencies of this work, and were specially made by Messrs. Greenwood & Batley, Ltd., Leeds.

Griffin's Electroscope.

Messrs. J. G. Griffin & Sons, Ltd., of Kingsway, London, W.C., are putting on the market an electroscope (see fig. 4) for accurate measurements in radio-activity, as designed by Prof. Rutherford, and constructed for the Physical Laboratories of the Manchester University by Mr. Chas. W. Cook.

This form of electroscope has been specially designed for the accurate comparison of activities measured by the α rays, and has a very wide range of usefulness in the laboratory, both for teaching and research purposes. In the lecture room its design makes it suitable for lantern projection. It is the standard form of apparatus for (1) accurate comparison of the activity of radio-active minerals and preparations in general; (2) the determination of rise and decay curves of the numerous radio-active products. With a slight modification it may be used to measure the amount of emanation from thorium and actinium. The instrument consists essentially of two parallel plates, the upper of which is connected to a gold or aluminium leaf system through a sulphur cone, the lower plate being connected to the base of the instrument.

The electroscope is charged by any of the usual methods by touching a projecting rod, which, after charging, is covered by a metal cap. The material to be tested is placed on a suitable metal vessel on the lower plate, which is made to slide in and out. By this means the material can be readily placed in a definite position without disturbing the upper plate.

In designing this apparatus, particular care has been taken to make all the essential parts easily removable, in order to admit of rapid replacement either of a gold leaf or of the metal plates, should they by accident become contaminated by radio-active matter.

The instrument has a very low natural leak, and can be used for the determination of very small activities. It is constructed of aluminium, and mounted on a cast-iron base. In size it is about 10 in. high, on a base 6½ in. square. The movement of the gold leaf should be observed by a reading microscope with a scale in the eyepiece.

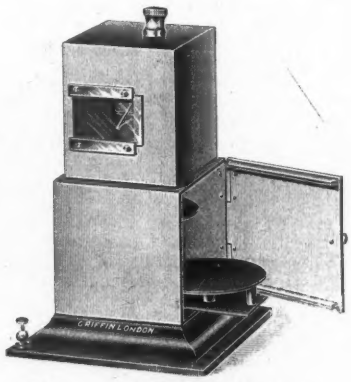


Fig. 4.—Griffin's Electroscope.

We have received from Messrs. Griffin a leaflet relating to their slide rules and calculators, planimeters, and curve paper; also a small pocket list of some 40 pages, being a catalogue of scientific and technical literature which they have in stock. The firm opened a "books department" a few months ago, where would-be purchasers of scientific and technical literature can inspect whatever books are on view before buying. To such, a perusal of this little catalogue in advance of their visit, would be of use.

The Lucea Arc Lamp.

A 12-page list of flame and enclosed arc lamps for the 1907-8 season has just been issued by Messrs. Falk, Stadelmann & Co., Ltd., 83—87, Farringdon Road, London. The "Aureola" intense flame arc lamps for indoor and outdoor use on D.C. and A.C. circuits are particularised, with prices and catalogue numbers in tabular form. The "Lucea" and the "Lucealet" enclosed types of arc lamp are also described, as well as certain arc lamp lowering gear and accessories, and the "Noris Excello" flame carbons.

Fig. 5.—The Lucea Arc Lamp.

In regard to the "Lucea" lamp, which is shown in fig. 5, the makers' claims are:—Simple mechanical design; high electrical efficiency; shadowless; short overall length; easy trimming; long burning hours; insulated cases; equally silent on direct or alternating circuits. As there is nothing in the lamp to wear out or to lose adjustment, the cost of repairs is said to be practically nil. The lamp has an outer case, made entirely of copper, and insulated from the interior of lamp. The mechanism is well protected against the injurious effects of dust, &c. It is claimed to be equally suitable for indoor or outdoor use, without the provision of a weather-hood, the terminals being well protected. The globe cover is made of brass and is not liable to rust, thus it is claimed that a perfect surface permanently ensures the exclusion of air, and thus economy in the use of carbons. In the direct-current series lamps all risk of the shunt coil burning out is obviated through its being protected by an automatic cut-out. The "Lucea" lamps are guaranteed by the makers for a period of twelve months.

A Compact Pumping Plant.

Messrs. J. W. Brooke & Co., Ltd., of Lowestoft, are busily engaged in developing the utility of the petrol engine.

The illustration (fig. 6) herewith depicts one of their 4-h.p. single-cylinder motors mounted on a bed-plate, driving a centrifugal pump with 3 in. discharge, and capable of throwing 150 gallons of water per minute to a height of 20 ft.

The base-plate which carries the engine and the pump forms a tank, which by means of a three-way cock can be used when the engine is first started and before the main pump discharges, and

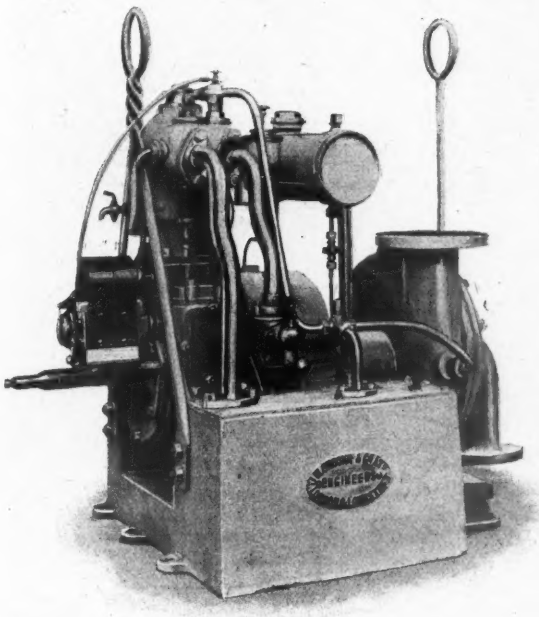


Fig. 6.—Brooke Motor-Driven Pump.

the charge from the engine pump will charge the centrifugal pump for starting. When the engine is running, the circulating water is drawn from one side of the centrifugal pump and returned to the other side. At the same time this base is used as a silencer.

The ignition to the engine is by Simms-Bosch high-tension magneto, and the pump runs at 1,000 r.p.m., the consumption of petrol being one-third gallon per hour.

The two slings noticed in the illustration are for slinging the whole outfit on a long pole for carrying purposes, the weight only being 4½ cwt.

Martyn's Patent Watertight Fuse.

An ingenious watertight fuse, specially designed for street lighting, but applicable also to house services, colliery work, &c., has been brought out by Messrs. S. W. Martyn & Co., of 11, Pratt Street, Camden Town, N.W. The method of applying the device to a

Fig. 7.—Watertight Fuse.

street lamp-post, where it takes the place of one of the usual ladder-arms, is shown in the accompanying illustrations (figs. 7 and 8). The principle adopted in Martyn's motor-car terminal, which we illustrated in our issue of July 5th last, p. 6, is here again utilised for making the connection with the fuse-wire as well as with the leads. The latter are shown at A, fig. 8, passing through two porcelain blocks B and C into coned terminals D, which can be withdrawn for wiring, and hold the stranded wires with perfect security and good electrical contact. After wiring, the porcelains are drawn

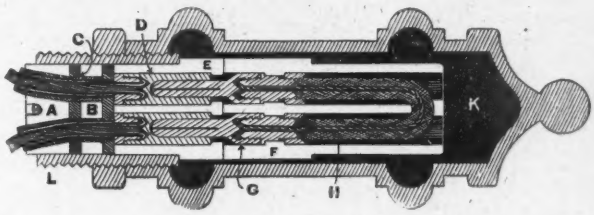


Fig. 8.—Section of Fuse.

together by means of a wire yoke and a pair of nuts, which compress rubber washers E between the blocks and make the whole perfectly watertight. The fuse-wire is enclosed throughout in an asbestos tube H, in a porcelain block F, and is similarly gripped in coned terminals G, the ends of which form split plugs fitting the sockets attached to the leads. The fuse-block can be inserted or removed without fear of shock or burn, and is protected by the hollow cast-iron arm, which is screwed on the nipple L projecting from the lamp-post, as shown.

It will be observed that all the current-carrying parts are enclosed in porcelain; the device is easily wired and the fuse renewed, and it is so far watertight and airtight that it is guaranteed to work satisfactorily even when immersed in salt water. No tools are required when replacing the fuse. The insulation is very high, and, thanks to the long break—5 or 6 in.—and the enclosure, the fuse acts successfully on high-voltage circuits. At present the fuse is made in one size only, to carry up to 15 amperes at 650 volts. Special advantages claimed for it are—simplicity, safety, and ease of replacement of fuse.

Simplex Universal Coupling.

This fitting, shown in fig. 9, is supplied by Messrs. Simplex Conduits, Ltd., and consists of a hollow ball or sphere with two nipples for receiving socket or screwed conduit; this sphere is split, the two halves being attached together by means of a long screw. This passes through a clearing hole in one half and screws into a tapped hole in a small boss in the other portion; tightening

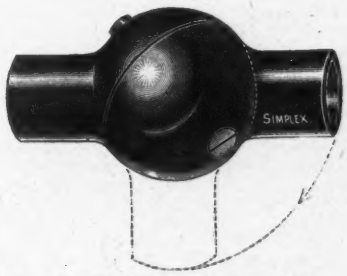


Fig. 9.—The Universal Coupling.

up the screw, of course, binds the two sections firmly together, each being provided with a lip so as to obtain a perfect fit. The line of division of the fittings is at 45 per cent. to the horizontal, so that the action of turning one nipple of fitting causes it to take up a position out of line with the other nipple, although remaining in the same plane; thus any angle between the two can be obtained from 180° (in which case the fitting forms a coupling piece) to 90° (when the fitting acts as a sharp bend). In addition to this advantage of obtaining an accessory which may be used as a coupling or as a bend, a convenient inspection point is provided.

The East Indian Railway Electrical Department.

—*Indian Engineering* says that the formation of this branch as a separate department of the East Indian Railway, under Mr. H. L. Tyson-Wolff as electrical engineer with two assistants, has now been in operation for some months, the only question left for future settlement being that of the permanent headquarters. "We understand that this has now been decided in favour of Jamalpur (the locomotive headquarters), and in preference to Lillooah which is not considered in every way so suitable. Calcutta was, of course, impracticable. The vacancy caused by the recent unfortunate death of Mr. H. H. Hodd, assistant electrical engineer, from enteric, after being only six months in the country, is being filled from Home."

LEGAL.

Herbert Morris and Bastert, Ltd., v. Mayor, &c., of the Borough of Loughborough.

This case came on for hearing before the Court of Appeal consisting of the Lord Chief Justice and Lords Justices Buckley and Kennedy on Friday last. The action was brought by the plaintiffs against the defendants for damages for alleged breach of contract.

The statement of claim alleged that by an agreement in writing on January 18th, 1904, between plaintiffs and defendants, the latter agreed to supply electrical energy to the plaintiff company on certain terms and conditions. Plaintiffs are electrical engineers in Loughborough, and the contract was entered into, as the defendants knew, for the purpose of supplying electrical energy to the plaintiffs in the business. The plaintiffs' case was that about 3 p.m. on November 22nd, 1905, defendants wholly neglected and failed to supply electrical energy in accordance with the contract, and such neglect and failure continued for six hours. During that time the plaintiffs' works were stopped and 200 of their workmen were left idle. Plaintiffs claimed £100 damages.

The defence alleged that by the Loughborough Corporation Act of 1899, they were authorised and required to supply electrical energy within (and many other places) the borough of Loughborough, subject to the provisions of the Act and the Electric Lighting Acts, 1882 and 1888. From and after October 21st, 1903, defendants supplied electrical energy to plaintiffs within the borough in pursuance and subject to the provisions of the Acts, and not otherwise. The maximum power to be supplied, the price to be charged, the mode in which the charges were to be made were to be ascertained along all the necessary lines, and the period of supply was agreed between plaintiffs and defendants, and embodied in an agreement dated January 14th, 1904. Defendants alleged that they never agreed to supply electrical energy to the plaintiffs save as aforesaid, and never made any contract with the plaintiffs. They denied that they neglected or failed to supply electrical energy to the plaintiffs or at all, and alternatively they objected that no action lay in the High Court in respect of the alleged neglect and failure. Defendants said that by virtue of Sec. 62 of the Corporation Act of 1899, the only liability incurred by them for neglect or failure to supply electrical energy was a penalty not exceeding 40s. per day, subject to the provisions of the said section contained and recoverable summarily or in the High Court. The agreement of January 18th, 1904, contained the following clause:—"The Corporation will supply electrical energy (hereinafter referred to as the 'permanent supply') to the company on June 30th, 1904, or as soon thereafter as they are able to do so, but in any event the said permanent supply shall be given to the company not later than September 1st, 1904, but the Corporation shall not be liable to the penalties prescribed by Sec. 62 of the said Act, or any other penalties, for any default in supplying energy before the said September 1st, 1904. After the said September 1st, 1904, or such earlier date as the Corporation commence the permanent supply to the company, all electrical energy supplied by the Corporation to the company shall be deemed to be permanent supply. This agreement shall remain in force for a term of three years from September 1st, 1904, and if the agreement is continued after the expiration of the said three years, the same shall be determinable by either party giving to the other 12 calendar months' notice in writing of their intention to do so. If either party shall desire to discontinue this agreement on the expiration of the said three years, they shall give to the other, 12 calendar months' notice in writing, expiring at the expiration of the three years."

At the trial, Mr. Justice Bigham thought the operating clause in the Act was intended to apply to all cases where, under the provisions of the Act, the authority supplied the energy. He did not see that it was intended to make any distinction between cases where the supply was under the ordinary provisions of the Act, and cases where the supply was controlled within the meaning of Sec. 65 as to the price by virtue of an agreement. It would be extremely inconvenient if there were any such distinction, and he could not think that the Legislature intended that there should be a distinction, for, if they had intended it, he thought they would have said so in plain terms. He was fortified in this construction of the Act of Parliament by the agreement itself, because the wording of it satisfied him that both parties contemplated that this section would soon apply; for they took good care in an early part of the agreement to state that until certain events had happened it should not apply; the inference, of course, being that after these events had happened, the penalty clause, according to the intention of the parties to the agreement, should apply. He thought they took the right view of the agreement when they were drawing it, in assuming that the penalty clause did apply; and that being so, he thought the action must be dismissed with costs.

Mr. Danckwerts, K.C., and Mr. Whateley appeared for the appellants, and Mr. Montague Lush, K.C., and Mr. T. Hollis Waller were for the defendants.

Mr. Shearman, on behalf of the appellants, contended that his clients were entitled to sue the respondents in the High Court to recover damages for the breach of contract of January 18th, 1904, whereby the respondents agreed to supply electrical energy to the appellants. It was true that Sec. 62 obliged the Corporation to supply electric energy when required to do so to those within a certain limited distance of the Corporation's mains under a penalty, but the supply in the present case was under a special agreement wholly apart from the Act, and having regard to the fact that the plaintiffs were outside the limits of the boundary of supply, and the Corporation had to lay a special main in order to supply the plaintiffs with energy under the agreement, the breach of that agreement did not entitle the plaintiffs to any remedy by way of penalties. The penalty section only applied where the defendants made default in the supply of electrical energy to those who had the power to request them to do so. There was a distinction between the contractual and the statutory obligation to supply energy, and therefore the plaintiffs were entitled to bring their action for damages upon the defendants' failure to perform the agreement to afford a contractual supply. Sec. 62 applied only to ordinary consumers who required a supply and not to particular consumers with whom the defendants had entered into a special agreement.

Mr. Lush, on behalf of the defendants, contended that the judgment of Mr. Justice Bigham was right, and should be affirmed. The agreement was made under Sec. 65, and that section only applied to and allowed agreements as to terms on which electrical energy was supplied. Such an agreement did not affect the penalty section or take away the statutory remedy for the recovery of penalties upon the defendants' failure to supply. He contended that the first clause of the agreement showed plainly that both sides intended the penalty section to apply.

The Lord Chief Justice, in giving judgment, said that he very much regretted that this matter did not receive more consideration from the learned Judge, as he thought the point to be decided was a very important one. After careful consideration he was unable to see any limitation in agreement to justify the defendants in saying that they were not liable for damage for breach of agreement. It must be remembered that the defendants' was a private Act of Parliament, and it incorporated the Electric Lighting Acts of 1882 and 1888, and therefore apart from any special section, it showed that the undertakers might enter into such contracts as were incidental to the supply. He saw nothing in the Statute which entitled him to say that Sec. 62 was meant to protect the Corporation in such a case as the present from the consequences of an ordinary breach of contract. The agreement in the present case was a great deal more than an agreement as to price. It referred to the pressure to be supplied, and Clause 4 provided that the plaintiff company should take all the electricity for their existing works from the Corporation save only that obtained from a small installation of plant belonging to the company already existing on the works at the date of the agreement. He thought, therefore, that the appeal should be allowed.

Lords Justices Buckley and Kennedy concurred, and the appeal was accordingly allowed with costs, and the action ordered to be set down for trial.

Bellamy v. The Wakefield District Light Railway.

This motion was mentioned to Mr. Justice Joyce in the Chancery Division on Friday. Counsel stated that if his Lordship allowed it to stand over for a fortnight a settlement might in the meantime be arrived at.

His Lordship assented.

Lloyd's v. Marconi International Marine Communication Co. and Another.

The Master of the Rolls and Lords Justices Fletcher Moulton and Farwell on Tuesday heard the appeal of the defendants in this action from the judgment of Mr. Justice Kekewich.

Mr. Warmington, K.C., and Mr. Gover appeared for the appellants, and Mr. P. O. Lawrence, K.C., and Mr. Ashworth James for the respondents.

Mr. Warmington, in opening the appellants' case, said it raised a question of the true construction of two agreements between the parties of September, 1901, and November, 1905. Lloyd's was a corporation under an Act of Parliament, and its main purpose was the collection and distribution of maritime news. Lloyd's had dotted the coast of the United Kingdom with various signalling stations, the mode of signalling being either by flag or semaphore. When Marconi's invention was first published, Lloyd's naturally paid considerable attention to it. There were then two systems, and before adopting any one they were anxious to ascertain which was the best adapted to their purpose. They spent a considerable sum of money—some £4,000 he believed—on experimental investigation, and came to the conclusion that Marconi's system was most suitable to their requirements. At the time the first agreement was made, Marconi's had established stations on the English and Irish coasts, one being at the North Foreland. The point arose as to the rights of the parties with regard to what he must call the disestablishment of Marconi's established stations at the date of the agreement. It was admitted on both sides that the circle of influence was one with a radius of about 75 miles, and that messages from two stations within such a circle would be confused with each other, or, in technical language, jammed. Under the agreement, the International Co. granted Lloyd's the right to use the Marconi system for the sole purpose of maritime signalling at all Lloyd's stations then established, or to be established, during the currency of the agreement (which was to run for 14 years) in any part of the world, with certain exceptions, and Lloyd's were to give an order for installations in ten stations at least before a certain date. At this time Lloyd's station at the North Foreland was not in actual work; it was temporarily suspended. The question was whether

Lloyd's could at any time after the agreement give notice to Marconi's to equip their (Lloyd's) North Foreland station, in view of the fact that Marconi's already had a station there. Clause 2, which provided for the speedy installation of the apparatus and the payment to be made, was inconsistent with Clause 13, which provided that stations already established by the defendants should be worked by Lloyd's, who were to account to the company for the revenue. Where two clauses were inconsistent with one another, he submitted that the principle was to take the later clause as a proviso to the first, or an exception to it, and that it was incompetent for Lloyd's under Clause 2 to give notice to the company to equip a station for them at North Foreland, which would kill their own station. His contention was that all the established stations of Marconi's were excepted by Clause 13.

Lord Justice MOULTON: Surely we ought to hear the facts of the case. Nobody would want two stations within 100 yards.

MR. WARMINGTON: I should have thought not.

The MASTER OF THE ROLLS: There must be something else behind it.

MR. WARMINGTON: There are some facts, I know, but I do not care about them very much. The real importance to us is this. If what has been done, and according to Mr. Justice Kekewich, rightly done with regard to the North Foreland, is repeated at other places, our stations will be killed.

Continuing, counsel said litigation arose between the parties with regard to the agreement and what had been done under it. The defendants' allegation against Lloyd's was that the work was not done satisfactorily, and the plaintiffs had complained, he thought, of the defendants not equipping, or something of that sort. When the case came on for trial, the parties met and came to an agreement, which they possibly imagined would settle all their differences. Unfortunately, so far from settling them, he was not at all sure that they had not raised other questions. On November 30th, 1905, the plaintiffs notified defendants of five of the stations at which they required installations, amongst them being the North Foreland. Marconi's at first thought it was included by mistake, and the suggestion was made that a station on the coast of Scotland should be substituted. He could not say, however, that the notice was ever withdrawn. On the contrary, it was insisted upon, and it was made in this action the title that they had to show that they were to have their North Foreland station equipped, and the Judge said that that involved that Marconi's should have no station there at all. It also had this effect—that Lloyd's working of Marconi's old-established stations was objected to, and the objection was not acquiesced in by Lloyd's. That subsequently became the subject of further litigation before Mr. Justice Swinfen Eady, who upheld the objections made by Marconi's, and gave them the right which they insisted upon of going into the company's stations which Lloyd's had improperly worked.

Lord Justice FLETCHER MOULTON: Before that had Lloyd's station at the North Foreland been fitted up?

MR. WARMINGTON: No.

The MASTER OF THE ROLLS: You claimed then the right to work it?

MR. WARMINGTON: Yes.

The MASTER OF THE ROLLS: What is your present contention?

MR. WARMINGTON said the plaintiffs had been working, under Clause 13 in the original agreement, the defendants' station. The defendants said they were improperly working. Under the second agreement, their only remedy was to go in and work it themselves. That was disputed, and under Mr. Justice Swinfen Eady's judgment, the defendants established their right, and in June, 1906, they went into their own station and worked it. After this date it appeared from the correspondence that the suggestion was made—he was not quite sure on which side—that Marconi's must make use of Lloyd's North Foreland station, which was not then in use, and for a period of some weeks Marconi's removed the apparatus from their own station, and made what was rather a makeshift affair at the Lloyd's station. They had to fix up the aerial upon a lighthouse instead of upon a mast. Shortly after that the feeling between the two got acute. The defendants took their apparatus away from the North Foreland station of Lloyd's and took a place from Trinity House, as the tenancy of their own original station was about to determine. The plaintiffs said they were entitled to make the defendants equip their North Foreland station and abandon their own, because the two could not be worked together. They had made Clause 2 the over-riding and predominant clause, not reading Clause 13 as a proviso upon it. Under Clause 2 alone, Lloyd's would be able to require the equipment of every one of their signal stations on the southern coast, two or three of which were in the neighbourhood of Marconi's stations, and would make them unworkable.

After further remarks from Counsel, their LORDSHIPS delivered their judgment, dismissing the appeal with costs.

Electromobile Run.—The *Pall Mall Gazette* reports a test of one of the Electric Landaulet Co.'s new Mercédés electric cars, fitted with gearless hub motors. The run from Chelsea to Brighton was accomplished in 2¾ hours, at an average speed of 19·6 miles an hour. The battery was not exhausted on reaching Brighton, and the run was finished at normal speed. After recharging, the return journey was made. There was no accident of any kind, and on reaching the Chelsea garage, the battery being still not exhausted, a further run of about 12 miles was made, making a total distance on the single charge taken at Brighton of 68 miles.

ELECTRIC v. HYDRAULIC CRANES.

BY E. H.

AT the Engineering Conference this year, in the discussion upon Mr. Squire's paper on "Dock Equipment," attempts were made to belittle the progress of electricity in connection with crane work, and it was seriously argued that, on the ground of cost alone, not only was the advantage with hydraulic lifting, but that this superiority was likely to be maintained and become even greater in the near future.

One of the speakers gave some figures, furnished by friends of his, as to the costs of working under the two systems, and supplemented these by his own estimates of the probable comparative repairs costs of both electric and hydraulic cranes. He contended that while, at first, the annual outlay in each case would be about equal, after a few years' running there would be a wide diversity. In fact, he went so far as to suggest that, whereas £5 per annum would probably always cover the maintenance of a hydraulic crane, the repairs of one electrically driven might, after the lapse of these "few years," easily amount to £20 or £30 in a year.

But surely, if this were correct, the use of the electric crane would have been abandoned, as an expenditure of this amount would indicate either frequent stoppages for repairs, or running, for at least some time, at less than normal efficiency, with, in the end, a cessation of work altogether for the considerable time which would be required for a thorough overhaul. Economical work under these conditions would be impossible.

Fortunately, however, the experience of crane users does not bear out these views, as will be seen from the following particulars furnished to the writer. The first instance relates to a crane working on the river-side at Hammersmith, which has been in constant use for some six years. It has a lifting capacity of 2 tons with a radius of 36 ft., or of 5 tons with a radius of 16 ft. The lift speed for the smaller load is 75 ft. per minute, decreasing, of course, with the heavier weight.

On a recent occasion this crane was landing coal from barges. The cycle of operation was: Lower empty skip to barge, raise load, swing for half-circle, and lower to cart. The average load per skip was 15 cwt. and the total quantity handled was 76 tons. The amount of energy consumed was 42 units, which, at the rate charged by the local authority, worked out at ·663d. per ton. The following day the same crane was unloading broken granite. In this case the skip held about 23 cwt. and the total weight handled was 74 tons. The energy consumed amounted to 66 units, or a cost of 1·070d. per ton.

With regard to the question of repairs, the actual figures are as follows:—In 1902, nil; in 1903, 7s. 6d.; in 1904, nil; in 1905, £1 14s. 4d.; in 1906, nil; in 1907, £5 14s. 6d.; or an average cost of £1 6s. 1d. per annum. I think that these figures compare very favourably with those mentioned in the discussion, particularly those relating to repairs. The figures which I give are not problematical or estimated, but are the actual results obtained with a crane in ordinary every-day use.

Further inquiry along the river does not bear out the case claimed for hydraulic power. For instance, a large firm of wharfingers and shipowners, whose river-side premises cover some acres of ground, have in use at the present time cranes driven by steam, by hydraulic power and by electric motor. As these people handle something like a million tons of goods per annum, they are, if anyone is, thoroughly competent to judge of the relative values of the respective systems.

Now, what do they say? Their verdict, as given personally to the writer, is emphatically in favour of electric driving, not, as some might expect, on the ground of flexibility and convenience (as apart from the question of cost), but purely on the question of cost alone. These people use two types of cranes—viz., wall cranes, and cranes on a floating wharf or jetty. The lifting capacity of the former is 1 ton, and the lift speed is 200 ft. per minute. They are fitted with jibs having a rake of 25 ft. The specified duty is 45 cycles per hour, including lifting through the

full height of 78 ft., and slewing through a range of 180°. The cranes are geared direct by single-reduction machine-cut gear, and are equipped with motors of 24-B.H.P. The slewing gear consists of 2-B.H.P. motors directly coupled to the worm shaft, the drums being keyed to the worm wheel shaft and connected to the jib-slewing drums by chains.

There are three jetty cranes. The wall cranes and the jetty crane to which the following particulars refer were erected by Messrs. R. Waygood & Co., Ltd. :—The jetty crane has a load capacity of two tons at a speed of 200 ft. per minute at full load, and of 280 ft. per minute with a load of 25 cwt. per minute, both on a single lifting chain. The crane is fitted with derricking gear and is capable of luffing the jib from 70 to 30 ft. radius in 15 seconds. It is capable of making complete revolutions in either direction, and has a slewing speed of 500 ft. per minute. A separate motor is used for each movement—viz., lifting, luffing and slewing, the crane is of the gantry type, and is constructed to run on rails of 18 ft. gauge and with a clear headway of 10 ft. 6 in. Hand gear and handles are fitted for travelling the crane along the rail. The luffing gear enables the crane to work at 40 sets per hour at full load. The gearing of the hoisting winch is of the single-reduction spur type, the wheels having machine-cut teeth. The luffing gear consists of worm and wheel gear running in an oil bath and fitted with special friction as well as magnetic brakes.

Unfortunately, no records have been kept of the consumption of energy upon any particular job, but the wharfingers are absolutely convinced that electric driving is the cheapest of the three systems which they are using, and any extensions they may make in crane equipment will certainly be electrical. At the wharves in question, as at others, it is, of course, necessary that the cranes should have a certain maximum lifting capacity, but the machines do not often run at full load and this, naturally, is the primary reason why they are found to be more economical when driven by motor.

The average load is not more than 50 per cent. to 75 per cent. of the full capacity, and as the consumption of electrical energy varies, practically, in proportion to the load carried, whilst the consumption of hydraulic power remains virtually the same when a reduced load is carried, the advantage at the meter is clearly with electric driving. The wharfingers pay 1¼d. per unit for electrical energy, and their annual consumption is about 100,000 units.

The cranes have now been running some three years, and, during this period, the cost of repairs has been of a very trifling character ; but, even allowing (which, as a matter of fact, the wharfingers do) that the cost of maintenance is slightly higher in the case of the electric cranes than in the case of the hydraulic machines, the former are so much cheaper in working that the balance on the question of cost still remains in their favour.

Another interesting case may be given, at Blackwall. In this case three cranes are in use handling goods on the river bank. One is of 3 and the others of 2 tons lifting capacity. They handle about 80,000 tons of goods per annum. Current is taken from the Poplar Borough Council, the price, of course, being 1½d. per unit. The consumption of energy per ton lifted is stated to be ·08 unit. The cranes are driven by single motors, the lift speed being 75 ft. per minute at full load and 110 ft. at half-load. They have been working for 15 months, and have given absolutely no trouble, the cost of repairs having been practically nil. So satisfactory, indeed, have they been found in every respect that considerable extensions are contemplated, it being expected that the number of cranes will ultimately be increased to at least a dozen.

It would be perfectly possible to enumerate many other examples by the simple process of making further inquiry, but, probably, the instances given above will be sufficient to show the superiority of electric driving for crane work on the score of cost.

France.—La Compagnie Française des Accumulateurs Electriques Phœnix is the name of a new company which has just been formed in Paris (173 Bis Quai Valmy), with a capital of £12,000.

BUSINESS NOTES.

Consular Notes.—Russia.—The Austrian Consul at Odessa, in a recent report, states that at the time of the coming into force of the new Russian tariff it was believed that the increased rates of duty on electrical goods would stimulate the industry in Russia, and that the importation of these goods would greatly decrease. In practice, however, this has not been the case, for, in spite of the increased duties, the importation has been as great as in previous years. The trade with Germany, whose manufacturers hold a predominant position in the trade with Russia, has been fully maintained, in spite of the high duties on dynamos, incandescent lamps, &c.; this has been due, to a great extent, to political conditions in Russia causing increased wages, shorter hours of labour, &c., and consequently necessitating high prices for goods produced in the country. The dependency of the Russian electro-technical industry on Germany is shown not only in the import trade, but also in the fact that the two large German producers—the Siemens-Schuckert Werke and the Allgemeine Elektrizitäts Gesellschaft—have their own branches in the country. The former firm has a branch in St. Petersburg under the title Russischen Elektrotecnischen Werke Siemens & Halske Aktien Gesellschaft, with a factory in St. Petersburg and ten branches in the provinces; the latter firm has a factory in Riga, under the title Russische Allgemeine Elektrizitäts-Gesellschaft, where machines and motors of heavy weight are produced, the duty and freight on these goods being particularly heavy.

The electro-technical industry in Russia has a great future, and a great field has been opened up in recent years by the installation of electric lighting in towns, the electrification of tramways, the installation of power in mines, iron and machinery works, &c. A part of the important demand for telegraph and telephone materials is satisfied in Russia, but the greater part is imported from abroad, chiefly from Germany, where electric meters, arc lamps, and carbons, are also obtained. Carbons are produced in small quantities by a Moscow house and a Warsaw house. Two incandescent lamp works are also to be established; up to the present these goods have been imported chiefly from Germany, but a few from Holland and Hungary; it is not anticipated that the importation will by any means cease after the establishment of the works referred to. Armatures for lighting purposes are imported for the most part from Germany, and Berlin firms do a large and energetic trade in the larger towns by means of agents. Accumulators are manufactured in Russia by the Russische Gesellschaft Tudor in St. Petersburg; there is also a small factory in Odessa. Cables and wire are manufactured in many places in the country, but nearly all the machines for these works, as well as the raw materials, are imported from abroad.

From this it will appear that the fear that importation of electrical goods would suffer from the imposition of higher duties has not been realised, and the Consul is of the opinion that a larger trade can yet be done.

With reference to the above, it may be stated that H.M. Consul at Windau, in a recent report, advises British manufacturers wishing to do business with Russia to pay greater attention to the manner in which their catalogues are compiled. First, they would attract more attention if they were in the Russian language; and failing that, the German language would be understood better than English, or even French would serve the purpose very well. Secondly, it is absolutely imperative that the materials of which the goods are made be clearly set out, or if they are composed of different materials the several sorts must be named with the approximate percentage of each; and likewise the weight of the article is absolutely necessary, and it must be given in Russian pounds, for which the equivalent is—one English lb. equals 1·108 Russian lb. Russia levies a duty on nearly every article imported, and the duty is in most cases calculated on the weight of the article. The material of which articles are manufactured affects the rate of duty levied. Therefore the foregoing details are of the utmost importance to intending purchasers of goods from abroad, in order to enable them to calculate the duty accurately. The British sellers should do their utmost to facilitate this calculation for would-be purchasers. Further, in all cases where it is possible, British makers should quote for their goods delivered free at the Russian port, duty not paid, thus relieving the buyer of the necessity of looking out for tonnage; this, in the case of an inland buyer, would go far to induce business.

Catalogues and Lists.—Messrs. Wm. McGeoch and Co., Ltd., 28, West Campbell Street, Glasgow.—The new catalogue of electric ship fittings that has been issued by this company is a fiuely illustrated production of some 116 pages in which a useful variety of manufactures of the class mentioned are neatly shown on art paper. A series of half-tone views of the different departments at the new Glasgow premises, the opening of which was referred to in the Electrical Review at the time, appears at the beginning of the book, among them being one of the electrical department, and one of the electric fittings showrooms. A number of similar views of the shops at the works at Birmingham follow. The catalogue is in three sections, "S" showing many designs of standard and Admiralty patterns, and ornamental lines, of pendants, brackets, hand lamps, bulkhead fittings, table standards, illuminated sign lanterns, &c.; section "F.S." relates exclusively to some attractive artistic figures in bronze; the final section, "P," deals with a good deal of electric lighting and bell material of Admiralty pattern. A glance through the catalogue shows that the firm have endeavoured to produce a book which embraces all the recognised standard patterns of ship fittings, and although the book is not a

large one, it is comprehensive and contains everything from standard fittings to the best class of saloon and state-room fittings, figures for newel posts, &c. The Admiralty lighting and bell material section will doubtless be appreciated by many contractors who have more particularly to do with this class of work.

The Electric and Ordnance Accessories Co., Ltd., Birmingham.—Thirty-six-page illustrated catalogue (F72), containing particulars and views of over 100 patterns of their "Stellite" electric on the Rivers and Eclipse systems, to which we made extended reference in our issue of October 4th. The company has a department devoted solely to the manufacture of this apparatus. Substantial orders have been booked recently for ship and factory heaters; of the former the company has made a speciality. The general principles of the systems are detailed in the list, and priced particulars and code-words follow beneath the various illustrations. Code-word and numerical indexes appear at the end.

The Electrical Fittings Co., Ltd., 38, Conduit Street, New Bond Street, London, W.—A new catalogue of electric light fittings has just been published by this company. It is bound in an impressively neat cover, and the large number of designs of fittings are illustrated in an admirable manner on art paper, while the letterpress matter is printed in light green. The book is divided into eight sections, each of which is paged separately, dealing with different classes of designs thus:—Section A, electroliers; B, ceiling fittings; E, pendants; F, pendants, adjustable; G, brackets; H, table and piano standards; J, floor standards; K, Newel and Bank standards, &c.; L, billiard fittings.

Trade Announcements.—It is stated in the *British Australasian* that the businesses of Noyes Bros., merchants, agents and contractors for electrical and mining machinery, of Melbourne and Sydney, have been formed into limited companies. There are to be no changes in the methods of either house, and the alteration has been made solely for family reasons, and at the same time in order to allow of the enlargement of the interests of some members of the respective staffs, who have been in the employ of the firm for many years. The boards of directors of the new companies will consist of Messrs. Edward and Henry Noyes and the members of the staff referred to. The capital of the company is £100,000 in 10,000 shares of £10 each. No shares are offered to the public.

The Birmingham Electrical Fittings Co. have appointed Mr. Geo. H. Newton, of Bright Street, South Shields, as their representative for the Newcastle district for the sale of their iron-clad switch and fuses, and registered switches and fuseboards, including their patent fool-proof switchgear.

Dissolutions and Liquidations.—I.T.E. Electric Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. P. F. Huddleston, 72, Finsbury Pavement, E.C., the liquidator, by November 30th.

Electrical Coal-Cutting Contract Corporation, Ltd.—A meeting is to be held at the York Buildings, Adelphi, Westminster, on November 20th, to hear an account of the winding up from the liquidator, Mr. J. A. Pendlington.

Messrs. Wilks & Booth, plumbers and electric light installers and ironmongers, 701, Lea Bridge Road, Leyton.—Messrs. H. J. Wilks and F. Booth have dissolved partnership. Mr. Wilks will continue the business under the old style.

Northern Electrical Supply Stores, Ltd.—This company is winding up voluntarily, with Mr. Alfred Dunbar as liquidator.

Medical Electro-Thermic Generator Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. H. W. Freshwater, 7 and 8, Railway Approach, London Bridge, S.E., by November 11th.

Book Notices.—*The Chemical Trade Directory.*—Third edition, 1907. Davis Bros., 265, Strand, W.C. 10s.—This is a directory of chemical manufacturers, merchants, brokers and agents, as well as makers of chemical plant, and is a work which cannot fail to be of great service to all buyers, sellers and many users of chemical products. Nearly 250 more names are included than appeared in the last edition, but the information is given in a compressed form enabling the publishers to produce the work at the above reduced price. Part I consists of an alphabetical list of firms' addresses with particulars of their supplies, telegraphic addresses and telephone numbers. Part II is a classified list of the firms in the different departments of the industry.

"Alternating-Current Motors." By A. S. McAllister. Second edition. New York: McGraw Publishing Co. 1907.

"Motor Manual." Tenth edition. London: The Temple Press, Ltd. 1907. Price 1s. 6d. net.

"Uber Versuche mit Lötmitteln." By A. Lippmann. Reprint from the *E.T.Z.* Berlin: Julius Springer.

"Fowler's Mechanical Engineer's Pocket Book, 1908." Edited by W. H. Fowler, Wh. Sc. Tenth edition. Manchester: Scientific Publishing Co. Price 1s. 6d. net.

Home-made Publicity.—Referring to the article in our last issue on this subject, the Technical Art Co., of Emerson Chambers, Newcastle-upon-Tyne, writes to point out that this company has taken up the special work of producing central station publicity matter on English lines, and will be pleased to give any electrical engineer interested in publicity matters an idea of its methods of electrical advertising, and the results which have already been obtained.

Electrical Companies and the Feared Railway Strike.—Dismayed by the prospect of a railway strike and the consequent difficulty of obtaining coal supplies, certain electrical firms, besides municipal electrical committees, in various parts of south-east Lancashire have during the last few days been getting in augmented stocks of coal. In some cases the fuel has been obtained from outside sources and at slightly enhanced rates. Interviewed by an Electrical Review correspondent, representatives of the Earl of Ellesmere, Messrs. Andrew Knowles and the Clifton and Kersley Co., three leading Lancashire coal-owners, admitted that a railway strike would play havoc with the coal trade, for the traffic at present is extremely congested.

Bankruptcy Proceedings. — Maunsell Mercier, electrical engineer, 83, Camp Street, Salford.—A receiving order was made on October 15th, at Salford Court, on a creditor's petition.

Messrs. Veritys and the N.E.M.A.—Messrs. Veritys, Ltd., notify us that they have resigned their membership of the N.E.M.A. They desire to state that this step will make no difference whatsoever to their attitude to the contracting trade, whose interests will always be carefully watched by them as heretofore. They consider, however, that they will be in at least as good a position to safeguard those interests when acting independently as when members of the Association.

LIGHTING and POWER NOTES.

Aberavon.—The T.C., on October 16th, decided to discuss with Margam U.D.C. the question of E.L., with a view to taking joint action in the matter.

Australia.—The protracted negotiations for a supply of electric light and power for municipal and private use in Balmain, Sydney, and for providing a destructor to dispose of all the town garbage, has been brought to a termination, Kennick & Co. having signed the agreement. The contractors have to get all plant, &c., ready in 12 months. The Sydney Council has acquired the business of the Strand Electric Lighting Co., Ltd., and the Empire Electric Light Co., Ltd. The new turbines that are being installed will give sufficient power to transfer their customers to the Council's mains. As a result of the amended tariff, the Council had to pay £900 more duty on the last turbine imported.—*Australian Hardware and Machinery.*

Birmingham.—A L.G.B. inquiry was held on the 17th into the Corporation's application to borrow £81,900 for electricity purposes. There was no opposition.

Burmah.—The Electrical Inspector to the Burmah Government is drawing up a comprehensive scheme for the lighting of the many Government buildings in Rangoon, which will be supplied from the city installation. The existing plants in some of the larger buildings will, it is believed, be done away with.

Bury.—Messrs. J. K. Schofield, Ltd., have intimated to the Electricity Committee that they are prepared to install motors of 300 H.P. for driving their mill, and at the end of 12 months about 1,000 H.P. of motors, provided they can get an alternating supply. A sub-committee has been formed to deal with the matter.

Chesterfield.—A L.G.B. inquiry was held on October 17th into the application from the T.C. for a loan of £5,000 for electricity purposes, £2,500 being for mains, £1,500 for motors, and £500 each for meters and indicators. There was no opposition.

Continental Notes.—Norway.—The British Vice-Consul at Bergen reports that the falls from Ringedal Lake, with an area of about two square kilometres, are to be employed for power required by the Alby United Carbide Factories, and the North-Western Cyanamid Co., at Odda. Shortly after leaving the Lake the water is diverted into a tunnel about three miles long, having a fall of some 490 yds. to the fjord, where a power station of about 40,000 H.P., but capable of extension to 70,000 H.P., is being erected.

The Badische Anilin und Soda Fabrik have purchased the Matre River at the end of the Mas Fjord, between Bergen and the Sogne Fjord, calculated to afford some 30,000 H.P.

Steps are being taken for the construction, with German capital of a power station in the Kinso Basin, in Hardanger, and a factory, probably for the production of chemical manure, at Kinservik, on the Hardanger Fjord. It is proposed to dam up a chain of lakes and pass the water through a rock tunnel, about 2½ miles long with a 400-metre fall, to an upper power house, whence it is to be conducted through a similar tunnel to a lower power station. Hence the power is to be transmitted down the Huse valley to the factory near the sea at Kinservik. It is calculated that over 100,000 H.P. will be obtainable.—*Board of Trade Journal.*

Dunfermline.—For three years now the question of the electric lighting of Mr. Carnegie's native town has bulked largely in the discussions of the T.C. Two proposals were put before the board—a Corporation scheme, or a supply from the Fife Electric Power Co. When put to the vote both schemes were rejected, and the old Committee was replaced by a new body. At last week's meeting the convener of the new Committee asked the Council to give it power to again negotiate with the company which was agreed to.

Dundee.—The T.C. has been advised that it will not be possible to obtain powers in a prov. order before the Board of Trade to hire out motors and fittings, and in view of this, the proposal has been dropped. The steps taken by the town to municipalise the business were keenly opposed by private firms.

Erdington.—The electric supply was practically inaugurated on October 19th. The system of supply is three-phase, with 230 volts for lighting and 400 volts pressure for power. The Aston B.C. supplies energy at 6,600-volt pressure to three substations, where it is transformed for distribution to some 20 miles of cable network.

Huddersfield.—The Electricity Committee has appointed a sub-committee to deal with all matters connected with the installation and erection of new plants, mains, apparatus, and buildings for the three-phase scheme, and it has also been empowered to agree to terms with prospective power consumers.

The Committee has entered into large obligations with the largest textile mill in the district for the supply of energy.

India.—It is understood that the Bengal and North-Western Railway Co. contemplates an expenditure of over Rs. 90,000 on the further equipment of mail and passenger trains for electric lighting. About half a lakh is to be spent on fitting the coaching stock on the Tirhoot State Railway, and the balance of Rs. 40,000 on the Bengal and North-Western Railway stock.

An arc light equipment in connection with the additional electric lighting of the Delhi central station of the East Indian Railway is being supplied by the British Westinghouse Co.

The Maharaja Scindia, of Gwalior, has granted a concession to construct and work an electric tramway, supply electric energy for industrial purposes, and light the streets of the capital. Mr. S. J. Tellery is the managing director of the company.

Kinlochleven.—Aluminium works are now being erected here on an extensive scale. The work is being carried out by a company which already manufactures aluminium at the Falls of Foyers. To supply the water-power necessary, a reservoir is being made 1,000 ft. above sea level, which will hold 20,000 million gallons of water. The reservoir will supply the power house through a fall of over 900 ft. An electric railway will run from the factory to the end of Loch Leven, where a pier is being built for the shipment of aluminium. It is estimated that the work will occupy two years, but it is hoped that it may be far enough advanced next spring to permit the starting of one or more furnaces.

Linthwaite.—The U.D.C. has appointed a committee to inquire into the question of electric lighting.

London.—Westminster.—The reports of the Improvements Committee of the L.C.C., which was submitted at Tuesday's meeting, recalled the fact that the Improvements Act of 1900, in providing for the reinstatement of the Westminster Electric Supply Corporation's station at Millbank on a new site, provided that the plans of the station to be erected by the company on the new site should be approved by the Council. As amended by the Council's General Powers Act of 1907, it was provided that the Council should not enter upon the company's existing site until the expiration of two years and six months from November 1st, 1907, but if the plans had not been approved by that date, the period of two years and six months should be deemed to extend from any subsequent date on which the Council might approve the plans. The Act of 1907 also provided that the Council should grant, and the company should accept, a conveyance of the new site on or before November 1st, 1907. The Committee further stated that the settlement of the company's claim would form the subject of an arbitration to be held at an early date. The company had submitted plans, and the Committee thought that the Council, without prejudicing in any way its position in connection with the arbitration proceedings, might sanction the plans, and it recommended accordingly.

Hackney.—The L.C.C. has sanctioned the borrowing by the B.C. of £8,138 for buildings, mains and machinery and of £9,677 for mains, arc lamps, columns, &c., in connection with extensions of the street lighting in the same borough.

Marylebone.—The Lancashire Dynamo and Motor Co., Ltd., incurred penalties amounting to £300 on account of late delivery of a feeder booster. After negotiations with the consulting engineer, the company offered to rewind the low-voltage booster at Manchester Square and supply the balancer regulators to enable this machine to act as a feeder booster on the 480-volt network, in lieu of the penalties. This offer has been accepted by the Electric Supply Committee. The resident engineer has reported that if the bonus scheme originally sanctioned up to December, 1906, were applied for the six months ending June, 1907, there would be a bonus earned of 87·5 per cent. of the average weekly wage of each man included in the scheme. He further reported that no bonus had been earned for the previous six months during which the scheme had been in operation. The Electric Supply Committee has ordered that the bonus scheme be continued, and that the bonus earned be paid to the workmen entitled thereto.

Luton.—The T.C. has decided not to entertain a claim made by Messrs. Marshall, Brookes & Chalkley, Ltd., for £177 with respect to a fire at the firm's premises, caused, it was alleged, by reason of the condition of the Council's mains. The electrical engineer informed the Council that the fire was due to a short-circuit, undoubtedly caused by lightning during a storm.

Merthyr.—The B.C. has agreed to the terms for street lighting offered by the Merthyr Electric Traction Co., for the main street from Merthyr to Dowlais.

Newmarket.—The U.D.C. has invited the E.L. company to tender for the public lighting of the town.

South Africa.—Uitenhage.—At a public meeting of the ratepayers held on September 19th, the action of the T.C. was confirmed, as to the granting of a concession to Messrs. Bellad-Ellis & Co., electrical engineers, of Port Elizabeth, for the public and private lighting of the town by electricity, at an estimated cost of £12,470. The three-wire D.C. system is proposed, with 500 volts across the outers; distribution will be carried out by bare overhead mains. The street lighting will be by means of 15 arc lamps of 1,250 C.P. each and 100 "Tantalum" lamps of 80 C.P. each. The plant will consist of two Crossley suction gas plants complete; two Crossley horizontal gas engines of 54 H.P.; two 35-KW. generators and balancers; switchboard, pumps and accessories. The T.C. will receive a fixed sum of £825 per year for street lighting, and the charge to private consumers will be from 1s. to 9d. per unit. Mr. J. A. Barkley (manager of the Port Elizabeth electric tramways) was engaged by the Uitenhage T.C. to examine and report on the scheme as proposed by Messrs. Bellad-Ellis & Co.

South America.—Bahia Blanca.—The Senate has passed a Bill authorising the Bahia Blanca and North-Western Railway to supply electric light and motive power, public and private, to the city, in combination with the services of the Cia. Sudamericana de Luz y Fuerza already existing there.

Staffordshire.—Owing to the way in which costs of production have increased in the Staffordshire iron trade, iron-masters are seeking to drive the rolling mills by electric power. Sir Alfred Hickman, Ltd., Messrs. Bayliss, Jones & Bayliss, Ltd., and Messrs. Tupper & Co., Ltd., are reported to be making this departure, which, when completed, will involve an outlay approaching £50,000.

Stretford.—The U.D.C. has amended its application for a loan for electricity purposes. Instead of a sum of £53,460, a loan of only £36,445 has now been asked for, together with £2,723 excess expenditure and £3,000 for the purchase of motors for hire.

TRAMWAY and RAILWAY NOTES.

Australia.—The Victorian Railway Commissioners have arranged to install a semi-automatic electrically-controlled signalling system on the Hawthorn suburban line, in order to allow of more trains being run. The traffic between Hawthorn and Melbourne has increased so rapidly, that the ordinary signalling has been found inadequate to meet its requirements.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee an influential deputation attended in connection with the movement for the extension of the tramway system through the village of Ligoneil. The deputation put the views of the Ligoneil people, who are within the city area, before the Committee very forcibly. As a result of the interview, the Committee subsequently decided to place the matter on the agenda paper for the next meeting in order to discuss the cost and time of commencing the extension. One of the prime difficulties is the very steep character of the road over which the proposed extension is to be made, Ligoneil being practically on the side of a mountain.

Bradford.—As the result of the past half-year's working of the City tramways the balance in hand constitutes a record for any six months in the history of the undertaking. The half-yearly return of traffic shows that the total receipts from April to September have been £129,326 as against £126,584 taken during the corresponding period of last year, and the balance in hand is £16,307 as against £10,732. On the expenditure side the cost has been £82,966 as compared with £84,669 for the first six months of 1906. The contributions for interest and sinking fund have been £15,345 and £14,707 as against interest, £16,113, and sinking fund, £15,071. The working cost per car-mile has been 7·038d. as compared with 7·453d. for 1906, or a saving of ·415d. per car-mile, or £4,700. In the above figures no account is taken of the amount now being expended on the laying of track. Last year the surplus of the department was £14,536, and the amount spent on renewal of the permanent way was £14,981, or a loss on the year of £445.

Continental Notes. — Germany. — The municipal authorities of Crefeld have decided to equip the local fire brigade with a number of electric motor fire engines.

The Kaiser is adding an electrical motor landaulet to his fleet of automobiles. The new vehicle is being built by the Norddeutschen Automobil und Motoren Gesellschaft, of Bremen.

Ilford.—With regard to the extension of the electric tramways mentioned in the Electrical Review last week, the U.D.C. has decided to seek the necessary powers by means of a Parliamentary Bill. The opposition of frontagers along the route rendered it impossible to proceed by a prov. order.

Egypt.—A start has been made on the electric railway which is to connect Cairo and the coming town of Heliopolis. The distance of 10 miles is to be covered by the trains in about 15 minutes.

Great Harwood and Rishton.—The U.D.C. has consented to an extension of time for the construction of the proposed light railway for Blackburn, Whalley and Padiham, on certain conditions relating to the roadways, &c.

Haslingden.—In connection with the electrification of its tramways, the Corporation has decided to generate its own electricity, for which purpose a power station will be established. The conversion of the system from steam to electricity will be commenced on April 1st of next year.

Huddersfield.—The borough engineer's financial statement for the past six months respecting the tramways shows that the capital outlay to date is £112,902. The income for the six months is £44,118, or 10·84d. per car-mile compared with £42,360 and 11·03d. respectively for the corresponding period of last year. The total working expenditure is £20,676 or 5·08d per car-mile, as against £20,853 and 5·43d. The gross surplus is £23,442 or 5·76d. compared with £21,507 and 5·60d. The rent of leased lines (Linthwaite) absorbs £603, interest on capital £6,600, redemption of debt £4,935, and depreciation at 3 per cent., £6,194, leaving a net surplus of £5,110, or 1·26d. per car-mile compared with £3,175 and ·83d. Six cars are to be fitted up with slipper brakes as an experiment.

Leith.—The Corporation has decided not to proceed with the Granton extension at the present time.

London.—L.C.C.—The consideration was postponed on Tuesday for a week of a proposal by the Highways Committee in regard to the construction of tramways from Hammersmith to Harlesden. It is estimated that the expenditure would amount to £107,630. In the course of a report on the financial bearings of the scheme the Finance Committee states that it feels considerable difficulty in reporting upon the financial aspects, as so much depends upon the success which may attend the Franco-British Exhibition. The district through which the tramways would pass is at present very sparsely populated, and there would probably be at the outset, apart from the Exhibition traffic, a deficiency of from £4,000 to £5,000 a year.

St. Helens.—Electricity is stated to have been the cause of a fire in two shops on Thursday, 17th inst. It appears that a tramway guard wire fell across one of the trolley wires, creating a circuit from the latter through an iron standard, and along an underground gaspipe into the cellars of the shops. The gas was in some way fired, but, fortunately, not much damage was done.

South America.—Electric tramway developments move slowly in Monte Video. According to the *Review of the River Plate* the Germans promised the opening of their Ramirez service for November, but even then they will barely have begun their extensive network, and miles of track re-laid have as yet neither poles nor trolley wires erected. The heavy bogie cars built on the Continent for the Paso Molino service do not seem to be the success they were designed to be, being too noisy for comfort and too expensive in consumption of energy, and the St. Louis four-wheel cars are said to be found much more serviceable.

Southend-on-Sea.—The T.C. has received from the B. of T. an extension of time until October 4th, 1908, for extending the electric tramways to Croxson's Court and Half-Way House.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Central and South American Telegraph Co. has been authorised by the Argentine Government to establish a land line between Buenos Ayres and Mendoza, *vid* Mercedes, Junin, Rufino, Villa Mercedes and San Luis, with branch lines to Pergamino, San Nicolas and Rosario.

Canada.—The Board of Conciliation has awarded to the telegraphists of the Canadian Pacific Railway an advance in wages of 14 per cent., overtime for work on Sundays, and annual holidays without stoppage of pay. The Canadian Northern Railway has also conceded a rise in wages to its telegraphists.

Chile.—According to official advices from the Western Union Telegraph Co., the Central and South American Telegraph Co. have opened a telegraph office at Antofagasta, Chile, by joining a T-piece to their Iquique-Valparaiso No. 1 cable. It is the intention of the company to lay a cable to Antofagasta soon.

French West Africa.—Three telephone lines have been erected on the Upper Senegal and Middle Niger, connecting Kayes and Medine, Kita and Bammako, and Bammako with Kulikoro. Connection will shortly be made with Timbuktu.

India.—The Indian Government has nominated Mr. T. D. Berrington as Director-General of Telegraphs vice Sir Sydney Hutchinson retired.

Sweden.—At the end of 1905 the telegraph and telephone services were represented by 129,917 km. of line, 24,598 thereof being submarine cable, which includes half of the cables owned jointly with other Governments. The telephone system consisted of 75,604·8 km. of line in 1905, while 85,000 km. were owned by private undertakings. There were also 7,798 km. of telegraph line belonging to railway companies which were used only for their own private purposes. The number of telegraph offices was 2,434 at the end of 1905, being one for every 2,208 inhabitants. The number of employés in the telegraph service was 5,900.

Of the 3,192,608 telegrams dealt with, 2,920,158 were paid for and 272,450 were free. International traffic dispatched, received and passing in transit consisted of 1,610,220 telegrams. Of this number 656,244 were exchanged with Germany; 531,505 with Great Britain; 270,401 with Denmark; 228,365 with Norway; 104,913 with France and 80,340 with Finland. Owing to insufficient addresses 6,939 telegrams could not be delivered. Of 97 claims for refund of tolls 78 were allowed.

The number of conversations on the telephone system was 233,299,780, being an increase of over 21 per cent. on the previous year's result, and an average of 2,850 per instrument. International calls amounted to 185,134, as against 165,593 in 1904.

The net receipts for both services in 1905 were £461,972, as against £409,245 in 1904, and the expenses for the two years were £454,971 and £383,588 respectively, leaving a surplus for 1905 of £7,000.

It is stated in the Swedish Government reports for 1904-5 that £4,049 was spent in 1904, and £3,978 in 1905 in the purchase of new poles. Of the 18,483 purchased in the former year 15,179 were impregnated with sulphur of copper, while of the 18,258 purchased in 1905 only 9,412 were so treated. Many interruptions were caused by snowstorms and frost, and during 1904 one violent storm laid low 4,000 wires, which it took one month to repair.—*Journal Télégraphique.*

Submarine Cables.—The lengths of cables recently laid have been given as follows:—

Tangier-Cadiz	78·408	nautical miles.
Port au Basque-Canso	199·318	,, ,,
Waterville-Canso (1905)	2,237·570	,, ,,
Manila-Shanghai	1,264·400	,, ,,
Bonin Islands-Guam	899·100	,, ,,
Dominica-St. Lucia	109·000	,, ,,
St. Petersburg-Rodvig *via* Libau ..	792·000	,, ,,

Telegraph Inquiry Committee.—The P.M.G. has appointed a committee to consider the accounts and returns in connection with the telegraph and telephone services, and to report in what manner they can be modified or supplemented so as to show more clearly the financial result of those services.

Telegraph Messengers.—In view of the fact that under present conditions telegraph messengers, on the conclusion of their term of service, are thrown on the world without any settled prospects, arrangements are being made to ensure that in future they shall receive technical training in various trades during their service.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Curaçao-Coro Curaçao-La Guayra Curaçao-Maracaibo } Closed..	Jan. 12, 1906 ..	..
Tarifa-Tangier	Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904 ..	..
Garachico-Santa Cruz	July 12, 1906 ..	..
Las Palmas-Arecife	Aug. 18, 1906 ..	..
Brest-Dakar	July 22, 1907 ..	..
Midway Island-Guam	Sept. 22, 1907 ..	
Pernambuco-Ceara	Oct. 9, 1907 ..	..
Pernambuco-Para	Oct. 9, 1907 ..	Oct. 17
Guernsey-Jersey	Oct. 19, 1907 ..	..
Landlines.		
Puerto-Barrios	Aug. 9, 1903 ..	..

Wireless Telegraphy.—Marconi Trans-Atlantic Service.—On Thursday last week the Marconi stations at Clifden, in Ireland, and Glace Bay, in Nova Scotia, were opened for Press communications, and a number of congratulatory messages were transmitted in both directions. The charge is 2½d. per word for Press dispatches, to which must be added the cost of transmission by landlines at both ends. Ordinary messages will be accepted shortly, at 5d. per word. The cable companies' charges between London and New York are 5d. and 1s. respectively, but these are net.

A great deal of baby talk about the new service has appeared in the more sensational daily papers, much of it senseless beyond belief. One paper rashly published a photograph of the wireless messages leaving (or arriving at?) Clifden—covered with streaks of light, which, in point of fact, were nothing but the traces of stars, the plate having been exposed for half an hour.

According to the Central News, 14,000 words were dispatched across the Atlantic on the opening day, so that, as the speed of signalling is only 25 to 35 words a minute, the traffic must have been very heavy and continuous.

A *Times* correspondent says that the buildings at Clifden are mostly wooden huts, with the exception of the receiving and transmitting rooms, which form part of a permanent erection of steel. Peat, of which there is an abundant supply, is used as fuel for the boilers. The aerial consists of a number of tall masts arranged in a line facing seawards, and carrying a network of wires. "The operators here have a telephonic apparatus, with a very sensitive sounder, attached to their ears, and it is their trained sense of hearing and distinguishing the Morse signals transmitted from the overhead wire and ether, *rather than their sense of sight*, that enables

them to distinguish the Morse signals." The italics are ours. The staff at Clifden numbers over 70.

The time occupied in transmission is apparently about two hours. A correspondent of the *Daily Mail* in Nova Scotia, inquiring whether a message handed in at Glace Bay had reached London four hours later, received a reply by cable in 20 minutes, to the effect that the message had not arrived.

Later reports show that considerable delays in transmission have taken place, and the Marconi Co. blame the American landlines. The New York correspondent of the *Telegraph* states that a message of 75 words was nine hours in transit between New York and Glace Bay, and that the Marconi Co.'s general manager in Canada admits that unless messages are handed in at New York by mid-day (5 p.m. here), they cannot be sent in time for the next day's paper. Hence he and other correspondents had temporarily stopped sending messages to Glace Bay. It is suggested that the strike of telegraphists, or the jealousy of the land telegraph companies, which are allied with the cable companies, may be responsible for the delay.

Although cable shares fell, and Marconi rose for some days, the position was reversed towards the middle of this week, when the sensational reports ceased to appear, and reports of endeavours to raise fresh capital on the part of the Marconi Co., with delays in transmission of messages, took their place.

The Netherland Indies Government has granted authority to a company to establish wireless telegraphy between Java, Celebes, Borneo and neighbouring islands.—*Elektrotechnische Zeitschrift.*

Wireless Telephony.—It is stated that the U.S. Navy Department is about to install wireless telephone apparatus on all the battleships destined for the Pacific. Practicable telephony over a distance of five miles in all weathers is guaranteed by the company furnishing the instruments.

CONTRACTORS' COLUMN.

Openings for New Business.

ABERDEENSHIRE.—Alterations to Badenscoth School. J. Duncan, architect, Turriff.

AYLESBURY.—Important additions to Royal Bucks Hospital.

BANGOR.—New Government offices. Postmaster, Head Post Office, Bangor.

BARNET.—Isolation hospital. H. F. Traylen, 34, Great James' Street, Bedford Row, W.C., architect.

BARNSLEY.—Important additions to Parker Street Church. Ernest Dyson, architect, Barnsley; Alfred Ouram, builder, Barnsley.

BILSTON.—New schools in Queen Street for Holy Trinity Church. J. P. Baker, architect, 33, Market Place, Willenhall, Wolverhampton.

Extensive additions to Spring Vale Steel Works (£50,000). Alfred Hickman, Ltd., owners.

BIRMINGHAM.—Telephone installation (internal) at Monyhull Colony, King's Heath, for epileptics, for Birmingham, Aston and King's Norton Joint Poor Law Establishment. Clerk of the Works, at the Colony.

New church of St. Andrew, Oxhill Road.

BLACKPOOL.—New General Post Office in Abingdon Street for H.M. Office of Works.

Lecture hall and school in connection with Claremont Congregational Church (£1,900).

BLYTH.—Cowpen Quay Primitive Methodist Church to be reconstructed (£1,800). Davidson & Sons, architects, Newcastle-on-Tyne; Gordon Bros., builders, Stakeford, Morpeth.

BONNYBRIDGE (Stirlingshire).—Proposed new police station. Chief Constable of Stirlingshire.

BOURNEMOUTH.—New elementary schools in Middle Road for the T.C. F. W. Lacey, architect, Municipal Offices, Bournemouth.

BRADFORD.—New Baptist Sunday Schools (£4,000). Fred Holland, architect, 11, Parkinson's Chambers, Bradford.

BREDBURY.—New cotton mill for the Pear Spinning Co., Ltd.

BRIDGWATER.—New police court buildings for Somerset C.C. (£5,000).

BRIGHTLINGSEA (Essex).—New police station. F. Whitmore, county architect, Duke Street, Chelmsford.

BRIGHTON.—Offices for the London *Daily Telegraph* (£1,427). Joseph and Smithem, 83, Queen Street, Cheapside, E.C., architects.

BROUGHTON.—New Sunday School and parish room at Wetwood. Mr. Felton, builder, Croxton.

BURSLEM.—New Wesleyan Church, Sneyd Green. Ford & Slater, architects, Burslem; J. W. Brindley, builder, Wedgwood Saw Mills, Burslem.

CARDIFF.—New Congregational Church in Eyre Street, Splottlands. Habershon, Fawckner & Co., architects, Tredegar Estate Offices, 14, Pearl Street, Roath, Cardiff.

COLCHESTER.—Residence on Lexden Park Estate. Mortimer & Son, architects, Lindum Chambers, Romford.

COVENTRY.—New Institute, Balsall. E. A. Isherwood, builder, Balsall, Coventry.

DUNFERMLINE.—New shops in High Street for Thomas Christie, 97, Mill Street, Dunfermline.

Paint and oil store for J. N. Wilson, painter, Queen Anne Street, Dunfermline.

Additions to factory for W. Cunningham, manufacturer.

EASTBOURNE.—Electric ventilating apparatus at the Pier Pavilion. Eastbourne Pier Co., Ltd.

EAST WICKHAM (Kent).—New Vicarage. Thomas & Edge, builders, Anglesea Avenue, Woolwich, S.E.

FOLKESTONE.—New Harvey Grammar School for the T.C.

FRESSINGFIELD.—Alterations and additions to Fressingfield Voluntary School. J. Fisher, manager, Fressingfield.

GALASHIELS.—Proposed new Technical College in Market Street.

GARRISON (Co. Fermanagh).—New parochial house for the Rev. P. A. M'Cleary. J. V. Brennan, architect, Belfast Bank Chambers, Belfast.

GLASGOW.—New Church in Gower Street, Bellahouston. Robt. Scott & Son, surveyors, 115, Wellington Street, Glasgow.

GLASGOW.—New fire station. Corporation City Engineer.

Saw mills. J. B. Fraser & Co., 108, North Wallace Street.

GLOUCESTER.—Petty Sessional Court. M. H. Medland, county architect, 15, Clarence Street, Gloucester.

GOOLE.—New co-operative stores for Goole Co-operative Society.

GOURDON, MONTROSE.—New spinning mill. John Fyfe, plumber, Bervie.

GREENOCK.—Laundry buildings in Port Glasgow Road for Greenock and District Laundry, Ltd.

HANWELL.—R.C. schools (£3,500). E. Goldie, 31, Upper Phillimore Place, Kensington, W., architect; John Barker & Co., 52, High Street, Kensington, builders.

HARLOW (Essex).—New police station. F. Whitmore, county architect, Duke Street, Chelmsford.

HAROLD WOOD (Essex).—Adaptation of country house for Convalescent Home. F. E. Hilleary, town clerk, West Ham.

HARROGATE.—Two detached houses in Langcliffe Avenue for J. Hamilton Brown. H. E. Illingworth, architect, Wheatlands Road, Harrogate, and 8, East Parade, Leeds.

HEYWOOD.—New mill (60,000 spindles) for the Unity Ring Mill Co.

HULL.—New Wesleyan Church in Anlaby Street (£9,000). Rev. W. A. Hind, resident minister.

INCE.—New Men's Institute in Westwood Lane, Lower Ince, in connection with St. Mary's Church.

KELLY BRAY (Cornwall).—New Wesleyan chapel and schools. L. Scantlebury, architect, Callington.

LEEDS.—Important additions to Millshaw Leather Works, Churwell, for W. L. Ingle, Ltd. T. A. Buttery and S. B. Birds, architects, Queen Street, Morley, and 1, Basinghall Square, Leeds.

Extension to Pool schools. G. W. Watkinson, architect, 1, Mark Lane, Leeds.

New Salvation Army Hall in Meynell Avenue, Rothwell (£1,008).

LEICESTER.—New Primitive Methodist Church and schools, Coalville (£1,026). H. Harper, architect, Nottingham; J. Cole, builder, 129, Bridge Road, Leicester.

LIVERSEDGE.—Extensions to Stanley Mills. A. E. Rhodes, architect, Liversedge Hall Lane, Liversedge.

LIVERPOOL.—New police and fire stations in Lawrence Road for the T.C. (£4,000).

LLANHILLETH (Mon.).—New Parish Church (£4,600). Rev. D. Felix, rector.

LOCHGELLY (Fife).—Extension to Lochgelly Senior School (£7,000). W. Steedman, Lochgelly, clerk of works.

Proposed Municipal Buildings for Lochgelly. J. T. Scobie, architect, Dunfermline.

LONDON (Tottenham).—Additions and alterations to Bell Brewery. A. Dixon, 16, Holland Villas Road, W., architect.

(St. George-in-the-East).—Enlargement of Berner Street school (£2,237). T. J. Bailey, architect to Education Department L.C.C., Spring Gardens, S.W.

(Hoxton).—Adaptation of building for temporary school. T. J. Bailey, architect to Education Department of L.C.C., Spring Gardens, S.W.

(Greenwich).—Addition to glass factory in Anchor and Hope Lane. J. Cook, 1a, Eleanor Road, Woolwich, architect.

(Walworth).—Building in Portland Street. Messrs. Cluttons, 5, Great College Street, Westminster, S.W., agents.

(Northfields, W.).—Wesleyan school chapel (£2,500, inclusive of site). Rev. Joseph Dixon, 37, Hillcroft Crescent, superintendent Minister.

(Woolwich, S.E.).—Central car repairing depôt for the L.C.C. (£67,400).

(Shoreditch).—Warehouse in Shepherdess Walk (£3,777). Joseph and Smithem, 83, Queen Street, Cheapside, architects.

(Plumstead, S.E.).—Rebuilding of St. Nicholas' Church.

(Battersea).—Additions to Albert Bridge Flour Mills. Henry Lovatt, Ltd., Imperial Road, S.W., builders.

(Battersea).—Re-erection of 222 to 228, Lavender Hill. A. W. Taylor & Co., 159, High Street, Putney, S.W., surveyors.

(Battersea).—Adaptation of tramway depôt in Queen's Road for Incorporations, Ltd. F. Hazell & Co., 121, Victoria Street, S.W., agents.

(Piccadilly and St. James's Street).—Buildings for the Norwich Union Life Insurance Society. Ernest Runtz & Ford, 10, Wallbrook, E.C., architects.

(Holborn).—Buildings over Holborn Tube Station (Piccadilly Railway). Waring White Building Co., Ltd., 1a, Cockspur Street, S.W., contractors.

(Tooting).—Development of Furzedown Park Estate for building purposes. H. R. Millar, Ravenstone Street, Battersea, S.W. land agent.

(City).—Rebuilding 71, 73 and 75, Gresham Street, and 1, Aldermanbury for Fownes Bros. & Co., glove manufacturers.

(City).—Extension of premises (including 63, 64 and 65, Paternoster Row), for Nicholson, Ltd., 53, St. Paul's Churchyard, drapers.

(Fulham).—New central library (£15,000). W. S. C. Rae, Public Librarian; F. Wood, borough surveyor.

(Kilburn).—Enlargement of library (£1,630).

LUDLOW.—Alterations to the Grammar School. H. Brakspear, architect, Corsham, Wilts.

LUTON.—New workhouse buildings, board room, offices and laundry (£10,000) for the B.C. Gotch & Saunders, architects.

Rebuilding of mansion, Putteridge Bury, Bury Park. Beck and Ellis, Great Missenden, Bucks. Agents to owner, Thos. Meadows Clutterbuck, Chequer's Court, Butters Cross, Tring, Bucks.

LYDNEY (Dean Forest).—New cottage hospital. A. J. Dunn, architect, Clarendon Chambers, Birmingham; J. Byward & Sons, builders, Stroud Road, Gloucester.

MACCLESFIELD.—New Co-operative Stores in Bank Street for the Macclesfield Equitable Provident Society, Ltd. Edward Smith, president.

MANCHESTER.—Proposed new Sunday school in connection with Longsight Wesleyan Chapel.

New hospital for Women. Contractors, R. Neill & Sons, Strangeways, Manchester.

New church for Holy Trinity parish, Blackley. Basil Champneys, architect, Manchester.

Electric installation for pumping machinery at Royal Oak Print Works. Sackville & Swallow, Ltd., owners.

MATLOCK BATH.—Pump-room, baths, and pavilion under consideration (£20,000).

MORRISTON (Near Swansea).—New sheet mills for galvanising purposes. W. H. Edwards, Duffryn Steel and Tinplate Works, Morriston, owner.

NEWPORT (Mon.).—New church (£5,000 to £6,000) Cwmbran. J. B. Kempson, architect; W. A. Linton, builder, Newport, Mon.

NORTHAMPTON.—New church lit by electricity (£8,542). M. A. Holding, architect; R. Cosford, builder, Connaught Street, Northampton.

NORTHFLEET.—Queen's Head Hotel to be rebuilt. Wood & Sons, Ltd., brewers, Gravesend.

OBAN.—New Argyllshire sanatorium on Benvoulin estate.
OLDHAM.—New spinning mill, Chadderton, to be called the "Rugby." F. W. Dixon, architect, Oldham.
POOLE.—Proposed Municipal buildings.
PORTSMOUTH AND SOUTHSEA.—New district church (£8,000).
RATHMINES (Co. DUBLIN).—Additional accommodation at Vergemount Isolation Hospital for the Rathmines and Pembroke Joint Hospital Board. E. Bradbury, architect, College Park Chambers, Nassau Street, Dublin.
READING.—New Library (£4,000). F. W. Albury, architect, Reading; J. Kingerlee & Sons, builders, Oxford.
ROTHERHAM.—New library and reading room, Tickhill. P. N. Blundell, architect, 1, Prince's Street, Doncaster.
RUTHERGLEN.—Proposed extension of Town Hall (£6,000-£10,000).
SHIPLEY.—New soap works to be established.
SLEAFORD.—Alterations to 47, Southgate. J. Clare, architect, London Road, Sleaford.
SOUTHEND.—Additions to the Nore Yacht Club, the Cliffs. Trustees of Nore Yacht Club, owners.
New Church for St. Saviour's Parish, Westcliff.
SOUTH WOODFORD.—Proposed Cottage Homes for Children.
STAPLEFORD.—New Mission Church in connection with St. Helen's Church.
STONY STRATFORD.—Class-rooms, Vestry, &c., at the Baptist Chapel.
STURTON-BY-STOW (LINCS.).—Bakehouse, warehouse and stabling. W. Mortimer & Son, architects, Lincoln.
SWANAGE.—New "Wordsworth Home of Rest" (£4,800). Messrs. Crickmay, architects, 4, Mincing Lane, London.
TEDDINGTON.—Fire Brigade Station. M. Hainsworth, surveyor to the U.D. Council, Teddington.
TUNBRIDGE WELLS.—Bedford Hotel, High Street, to be re-built. R. V. Gower, solicitor to the owners, Tunbridge Wells.
WARRINGTON.—New Church, St. Margaret's, Orford. Albert Warburton, architect, 2, Bold Street, Warrington.
WELLINGBOROUGH.—New Church, St. Mary's (£6,000).
New leather factory near the Station, for Nicholson, Daniels and Clough, London and Northampton.
WEST HAM.—Aditions to Custom House school (£1,250). Architect, Education Department, Town Hall, West Ham.
WEYBRIDGE.—New police station.
WEYMOUTH.—New pavilion for the T.C.
WHITEFIELD.—New Wesleyan Church.
WHITEHEAD (Co. ANTRIM).—New parish church.
WINCHESTER.—New church (£15,000). Canon L. Gunning, M.R., St. Peter's, Winchester.
WOODFORD WELLS.—Church hall and vicarage in connection with All Saints' Church.
WORTHING.—Conversion of chapel, &c., into hostel for Missionaries for the Society for the Propagation of the Gospel. Miss May Cochrane, Warwick Gardens, Worthing, hon. general superintendent.
YEOVIL.—Detached houses in Prideaux Road and Ashburnham Gardens, P. D. Stonham, architect, Yeovil.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—NEW SOUTH WALES.—December 11th. Tenders will be received at the office of the Deputy Postmaster-General, Sydney, for the supply and delivery, at the Central Exchange, General Post Office, Sydney, of the following: 1,000 telephones, wall, common battery; 100 telephones, table, common battery. Specifications may be seen at the offices of the ELECTRICAL REVIEW.

SOUTH AUSTRALIA.—January 8th, 1908. One common-battery switchboard and 3,000 subscribers' telephones (specification No. 166) for the Deputy Postmaster-General, Adelaide. Specifications can be seen at the Commonwealth Office, 72, Victoria Street, S.W.

VICTORIA.—January 7th, 1908. The Postmaster-General requires tenders for 11 sections of a common-battery switchboard and 3,000 subscribers' telephones and other apparatus, for the telephone exchange at Windsor.

ADELAIDE.—November 26th. The Agent-General for South Australia, 28, Bishopsgate Street Within, E.C., has received specifications for tramway rails and fishplates required by the Adelaide Tramways Trust, which has the electrification of these lines in hand. A deposit of £3 3s. is required.

MELBOURNE.—December 17th. Five sections of telephone switchboard for Central Telephone Exchange, Victoria.*

BRISBANE.—December 16th. Insulators, iron spindles and copper wire for the P.M.G.*

PORT ADELAIDE.—March 11th. Common battery switchboard, subscribers' telephones and protectors.*

Caledonian Railway.—November 4th. The company invites tenders for electric lighting material and fittings. John Fergusson, stores superintendent, St. Rollox, Glasgow.

* Specifications at Commercial Intelligence Office, Board of Trade, 73, Basinghall Street, E.C. Tender forms at Commonwealth Offices, 72, Victoria Street, S.W.

Dublin.—November 4th. Three-phase low-pressure switchboard for the Dublin Corporation destructor depôt. See "Official Notices" to-day.

Dublin.—November 11th. Stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" to-day.

Edinburgh.—November 8th. Junctions and pits for tramways extensions for the Corporation.

Edinburgh.—October 26th. The School Board invites estimates for an electric light installation at Towerbank School, Portobello. Schedules of measurement at the office of Mr. Carfrae, architect, 3, Queen Street.

Egypt.—November 1st. Alexandria Harbour authorities. Electric power station and a number of transporters and capstans. Directeur des Postes et Phares.

Gloucester.—November 9th. Stores for the Light Railways Committee. See "Official Notices" to-day.

G.W. Railway.—November 12th. Stores for one year. See "Official Notices" October 4th.

Italy.—November 4th. The municipal authorities of Acireale, Catania, require offers for electric lighting and power plant. See this column for October 13th.

Llandilo.—November 2nd. 200 yd. electric light cable and four lamps for the U.D.C. R. Shipley Lewis, Clerk to Council

London.—November 5th. Electric light installation at the Lawn Lane School, Kennington, S.E., for the L.C.C. See "Official Notices" to-day.

New Zealand.—December 11th. The Napier T.C. requires tenders for electric tramways, lighting and power supply. Frank N. Bower, Town Clerk.

Portrush.—November 2nd. Lighting installation (electricity or gas) for the U.D.C. Specifications at the offices of the Council, Town Hall.

Spain.—October 31st. The municipal authorities of Zumaya (province of Guipuzcoa) are inviting tenders for the concession for the electric lighting of the town during a period of six years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Zumaya (Guipuzcoa).

Stepney.—November 11th. Steam and electric generating plant, &c., for the Council. See "Official Notices" October 11th.

Stockport.—Relaying permanent way. See this column last week.

Tunbridge Wells.—November 1st. 500-KW. turbine, alternator and exciter, &c., for electricity works. See "Official Notices" September 27th.

Willesden.—October 28th. Carbons for the U.D.C. See "Official Notices" October 18th.

CLOSED.

Aldershot.—The War Office has accepted the tender of Messrs. J. B. Saunders & Co., of London and Cardiff, for installing the electric light at the Government buildings at Aldershot.

Croydon.—The T.C. has accepted the tender of Messrs. S. H. Heywood & Son for an overhead runway, with skips, weighing machine, &c., for the coal-handling plant at the electricity works, at £234.

Dundee.—The Electricity Committee has accepted the following offers for plant in connection with the new station:—

Two turbo-alternators of 2,000-KW. each.—Willans & Robinson, £18,676.
Boilers.—Babcock & Wilcox, £14,735.
Cables for stock.—British Insulated & Helsby Cables.
Low-tension cables.—Siemens Bros. & Co.
Generators for turbo-alternators.—Dick, Kerr & Co.

The offer of the Oliver Arc Lamp Co., Ltd., for installing arc lamps in one of the oldest streets in the city, to supersede incandescent lighting, amounting to £91, was also accepted.

Glasgow.—The Tramways Committee of the T.C. has accepted the following offers:—

Rubber-insulated cable.—J. A. Rudd & Co.
Boiler feed pumps for Pinkston power station.—Mirrlees Watson Co.
Boilers, superheaters, mechanical stokers, fuel economisers, &c.—Babcock and Wilcox, Ltd.
Rails and fishplates.—Bolckow, Vaughan & Co.
6-sq. in. lead-covered cable.—W. T. Glover & Co.

The Sub-Committee on Stores has remitted to the general manager to purchase for trial from Walter Scott, Ltd., a quantity of rails and fishplates manufactured under the Sandberg specification, if he can make satisfactory arrangements regarding same with that company.

(*Continued on page 696.*)

BLAST-FURNACE GAS ENGINES IN GERMANY.

The visit to German gas engine installations, which was organised by Mr. Leonard Andrews and the Key Engineering Co., Ltd., was undertaken primarily with the special object of enabling British engineers to inspect the work of Messrs. Ehrhardt & Sehmer, for whom the former company are the British agents. The firm above-named has not long entered the field of large gas-engine building, but has already established itself in the front rank, as we shall show later. In addition to the gas engines, the works of Messrs. Lahmeyer and Co., at Frankfort, and electric winding machinery at a colliery, were attractive features of the programme.

The latter may be briefly summed up as follows :—

Tuesday, October 8th.—Visit to the Iron and Steel Works at Homécourt, in France, close to the border of Lorraine; here three Ehrhardt & Sehmer gas engines of 1,650 H.P. each were seen, coupled to three-phase generators, with a fourth in course of erection.

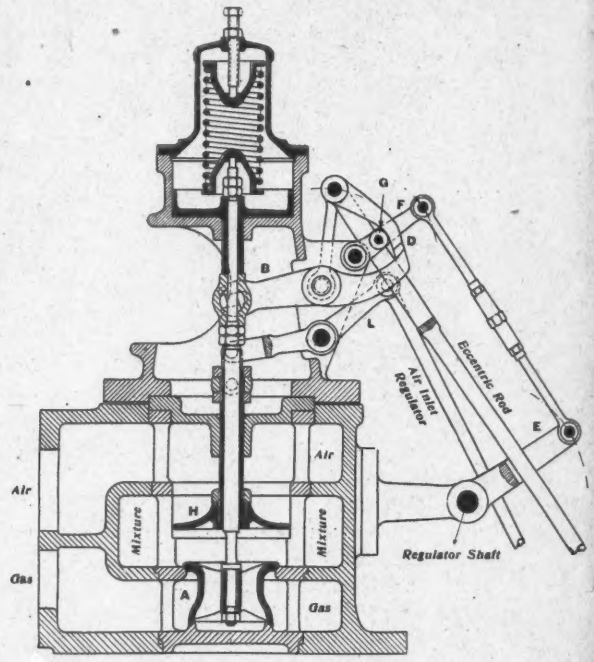
Wednesday.—Visit to the Stumm Iron and Steel Works at Neunkirchen, where two 1,000-H.P. E. & S. engines and two Körting engines were seen, driving blast-furnace blowers. This was followed by a visit to the Government mines at Heinitz, where an E. & S. 650-H.P. and a 1,300-H.P. engine were driving alternators in parallel, on coke-oven gas. The works of Messrs. Ehrhardt & Sehmer, at Saarbrücken, were visited in the afternoon.

Thursday morning was occupied with a visit to Messrs. Lahmeyer's works at Frankfort, and part of the afternoon by a most enjoyable trip down the Rhine from Rüdesheim to Coblenz in a steamer.

On Friday the Hoesch Iron and Steel Works, at Dortmund, were visited, the largest gas engines being seen here, and the largest installation of gas engines. The chief items of the plant were two Ehrhardt & Sehmer engines of 2,200 H.P. each, driving D.C. generators. The official programme ended here, but about half the party remained, and in the afternoon visited the Matthias Stinnes Colliery, where several sets of electric winders on the Ilgner system were seen.

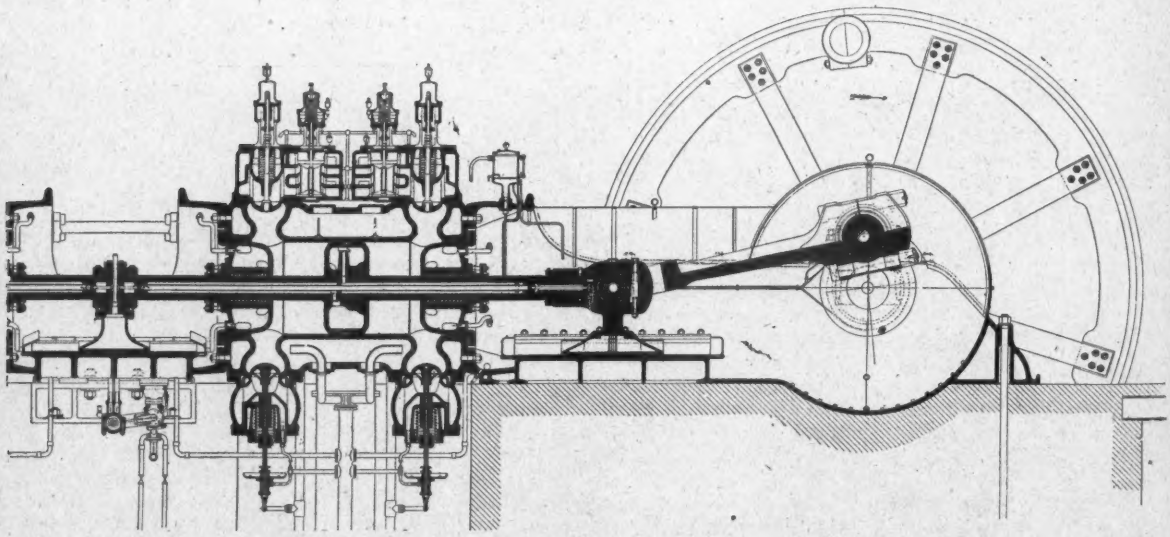
With this brief introduction, we may proceed to deal with some of the interesting features of the tour, beginning with the chief items—Messrs. Ehrhardt & Sehmer, their works and their work.

This firm was founded some 30 years ago by the parents of the present proprietors, the works being situated at Schleifmühle, near Saarbrücken, a town known to fame as the scene of one of the first battles in the war of 1870-1. The firm gave special attention to the manufacture of engines for rolling mills, pumping and winding, and a few years ago added to these the construction of large gas engines—first in association with the well-known Deutz Gas Engine Co., but latterly on lines of their own, which have proved highly successful.



Cross-section of Mixing Valve Gear.

Since the works were founded they have been repeatedly extended, and now give employment to nearly 1,000 workmen and officials. Part of the motive power is derived from the first gas engine built by the firm, of about 375 H.P., which is supplied with gas from a producer, and drives a dynamo. Since 1870 pumping engines of a total of 32,000 H.P. have been built by Messrs. Ehrhardt & Sehmer. Their winding engines are equipped with a patent expansion valve gear, which has proved highly satisfactory. While a number of



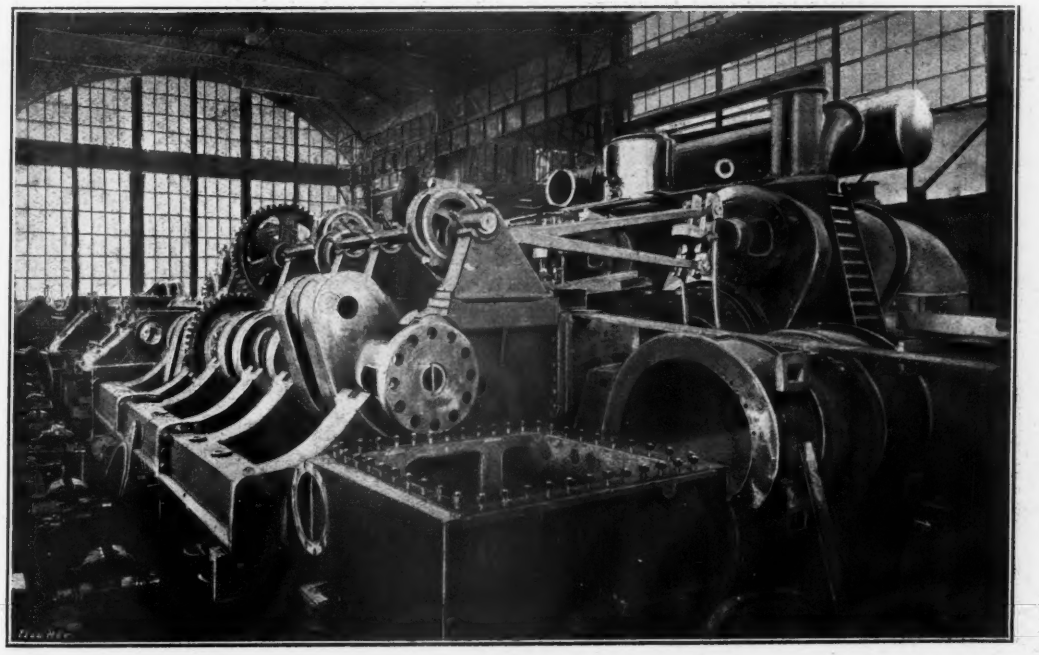
Ehrhardt & Sehmer Tandem Double-acting Gas Engine: Part Sectional Elevation Showing One Cylinder. Scale 1 : 85.

large gas engines, &c., were passing through the shops at the time of our visit, by far the most interesting item was a compound three-cylinder reversing rolling-mill engine of 20,000 H.P., intended for a Belgian steel works; this fine engine was in the erecting shop, and is shown in the accompanying illustration, though the latter hardly does justice to its massive proportions. The cranks are set at 120°, and the arrangement of three cylinders at this angle has been found highly satisfactory as regards uniformity of revolution, ease of handling, and economy of steam; some 54 rolling-mill engines, mostly of the three-cylinder type, have been built by the firm.

Obviously, in order to handle work of this magnitude, Messrs. Ehrhardt & Sehmer must possess exceptional facilities in the way of tools, cranes, &c., and so they do; one fly-wheel that was under construction weighed about 70 tons, and castings weighing 40 tons each are made in their foundry for the large engine beds. In this connection we wish to point out that the firm's success in building large gas engines is not a matter of luck or guess-work; it is due to the minute and painstaking care with which the work is controlled in every stage, from the drawing office, where Dr. Drawe, the firm's chief engineer, whose courtesy and geniality made him most popular with the visitors, is responsible for the designs, to the final erection of the completed engine. The extreme temperatures, excessive strains, and other abnormal conditions to which the parts of gas engines are exposed as compared with steam engines, render it essential, if success, which is another name for reliability, is to be ensured, to exercise the utmost care in the designs, so as to secure sufficient strength whilst avoiding unequal expansion of connected parts, and to provide for adequate cooling and lubrication; in the choice of materials, and in the constant supervision of their preparation, with frequent tests of their soundness and homogeneity during the process of machining; and in the workmanship itself, which is unexceptionable. Thanks to these precautions, Messrs. Ehrhardt & Sehmer have succeeded in the space of four years in establishing their reputation as the builders of large gas engines second to none in respect of reliability and economy; they do not make small engines.

The E. & S. engines are all of the double-acting four-cycle type, and are usually built tandem or twin tandem. Their design closely follows that of the typical German horizontal steam engines, in appearance and in general arrangements, though, of course, the differences are fundamental. The pistons are carried on hollow rods, joined by a cross-head between the cylinders, and supported by slipper guides, both there and at the head and tail. The stuffing boxes are metallically packed, and are very staunch; in only one case did we observe any sign of blowing. Cooling water is conveyed into the rods at the joint between the cylinders by long articulated tubes, and is carried to the ends of the rods by inner tubes; returning in the outer space from both ends, the water is guided through the bodies of the pistons, and finally leaves the rods as it entered. The pistons are packed with cast-iron rings. The lubrication throughout is mechanical, and is very thoroughly carried out, complete control at every point being provided.

Reference to the accompanying cross-section of the engine (p. 690) will show that the cylinder jacket and liner are cast in one piece, the former being provided with numerous hand holes for cleaning purposes; the thickness of the metal is as far as possible maintained constant, to avoid distortion by expansion and unequal strains, and to prevent excessive heating in any part, which might cause pre-ignition. The water space is very deep. Joints exposed to the hot gases are avoided to the utmost possible extent. The cylinders are supported entirely from their ends by the frame, distance piece and back slipper guide, and have no intermediate supports, thus leaving ample space beneath the cylinders in the foundations for the exhaust valve and gear. Moreover, the frame is fixed to the foundation at one point only, so that it is free to expand and contract with changes of temperature, without incurring strains.



Messrs. Ehrhardt & Sehmer's Engine Works: 20,000-H.P. Rolling-mill Engine in the Erecting Shop.

Ignition is effected by a simple device, always fitted in duplicate at each end of each cylinder. This consists of a solenoid connected in series with the ignition plug to the main lighting circuit or other source of supply, and actuating a striker which, when the circuit is momentarily closed by a commutator on the half-speed shaft, instantly interrupts the circuit inside the cylinder. The two circuits at either end are connected in parallel to the same commutator, which, being provided with four brushes, controls both cylinders of one tandem line. When a suitable supply current is not available, a magneto machine is used.

The half-speed shaft usually carries cams for actuating the valve gear, though eccentrics are sometimes used. The patent gas and air-mixing valve gear is of especial interest, and is illustrated in section herewith. The admission valve is opened always to the same extent and for the same time; the mixing valve is actuated by trip gear and controlled by a governor of the centrifugal type, the regulation of the

engine being effected entirely by varying the quality of the mixture, with constant compression.

The gas valve A is actuated by the lever B, which in turn receives its motion from an eccentric or a cam on the half-speed shaft through the trip D. The trip gear is timed by the governor through the levers E and F, which are connected by a link, the position of the roller G determining the time of closing of the valve. There is no air valve on the mixing valve gear.

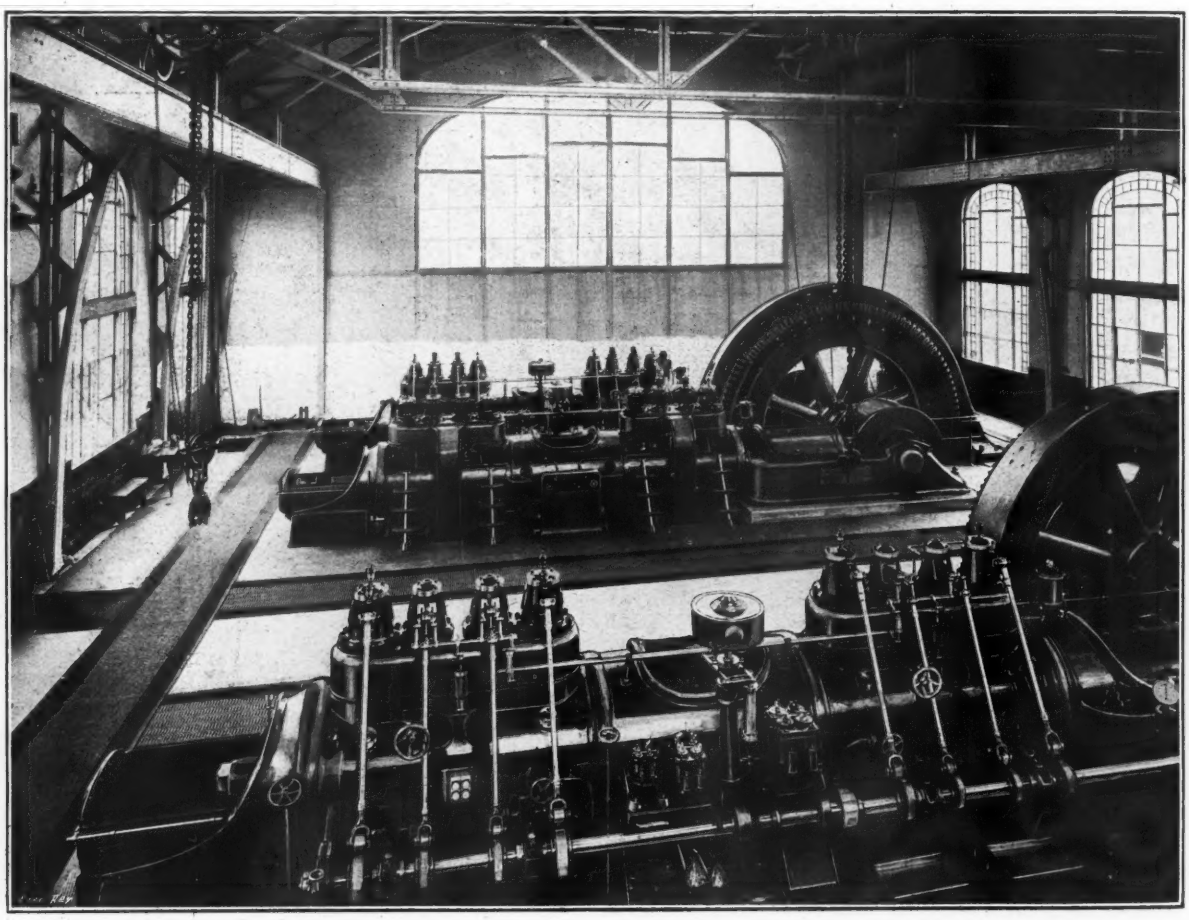
The gas valve is a simple double-seated equilibrium valve, closed by the spring shown above it, and cushioned by a dash-pot. There are no guiding surfaces in the gas passages, on which tar could be deposited and cause sticking. A round plate, H, fixed to a sleeve outside the gas valve spindle, is brought into the mixing chamber, and is adjusted by hand with the lever L, once for all, when the engine is started up. The adjustment is made to suit the quality of gas and other conditions peculiar to the case, and need not be altered so long as those conditions remain constant. Otherwise the disk acts merely as a baffle plate, allowing the gas and air o flow freely into the chamber and to mix there. The gas valve *always* closes before the end of the suction stroke, while the air valve *never* closes, so that, after drawing in the charge of explosive mixture, the piston sucks air into the cylinder at the end of the stroke. This ensures that there remains no explosive mixture in the mixing chamber, and renders back-firing impossible. There is always an excess of air in the gas-and-air charge, so that the whole of the gas is consumed, with corresponding economy. The governing obtained is very good, the gear accommodating itself not only to changes of load but also to variations in the quality or pressure of the gas. The latter, we may note, is usually cleaned to ·02 gm. per cubic metre.

The exhaust valves are shown water-cooled on the sectional view, but it has been found possible to dispense with this provision, and almost invariably now Messrs. Ehrhardt & Sehmer use plain mushroom valves without artificial cooling.

Turning to the installations visited, at Homécourt Iron Works there were three engines of 1,650 B.H.P. each, and two of 600 B.H.P. each, of Messrs. Ehrhardt & Sehmer's make, all two-cylinder tandem. A fourth 1,650 H.P. was in course of erection, and there were two earlier engines of Deutz make, with four cylinders each.

The large engines had cylinders 1,050 mm. in diameter, with a stroke of 1,200 mm., and ran at 95 R.P.M., driving three-phase 500-volt generators in parallel, which supplied power to a continuous rolling mill, pumps and other machinery about the works.

At the Stumm Iron and Steel Works there were two E. & S. blowing engines of 1,000 B.H.P. each, with cylinders. 850 mm. in diameter and 1,000 mm. stroke, running at 100 R.P.M. and blowing against a pressure of 7 lb. per sq. in. There were also two Körting engines of earlier construction.



Government Coal Mines, Heinitz: Ehrhardt & Sehmer Gas Engines Coupled to Lahmeyer Three-phase Alternators.

At the Government coal mines, Heinitz, there is a 600-H.P. tandem engine, and one of 1,200 H.P., twin tandem; the latter is shown in the middle of the accompanying illustration, and three more of the same size are in course of erection.

These drive three-phase 5,000-volt Lahmeyer generators, which work in parallel with an existing steam plant some distance away. The cylinders of all these engines are of 630 mm. diameter and 750 mm. stroke, running at 150 R.P.M. Coke-oven gas is employed.

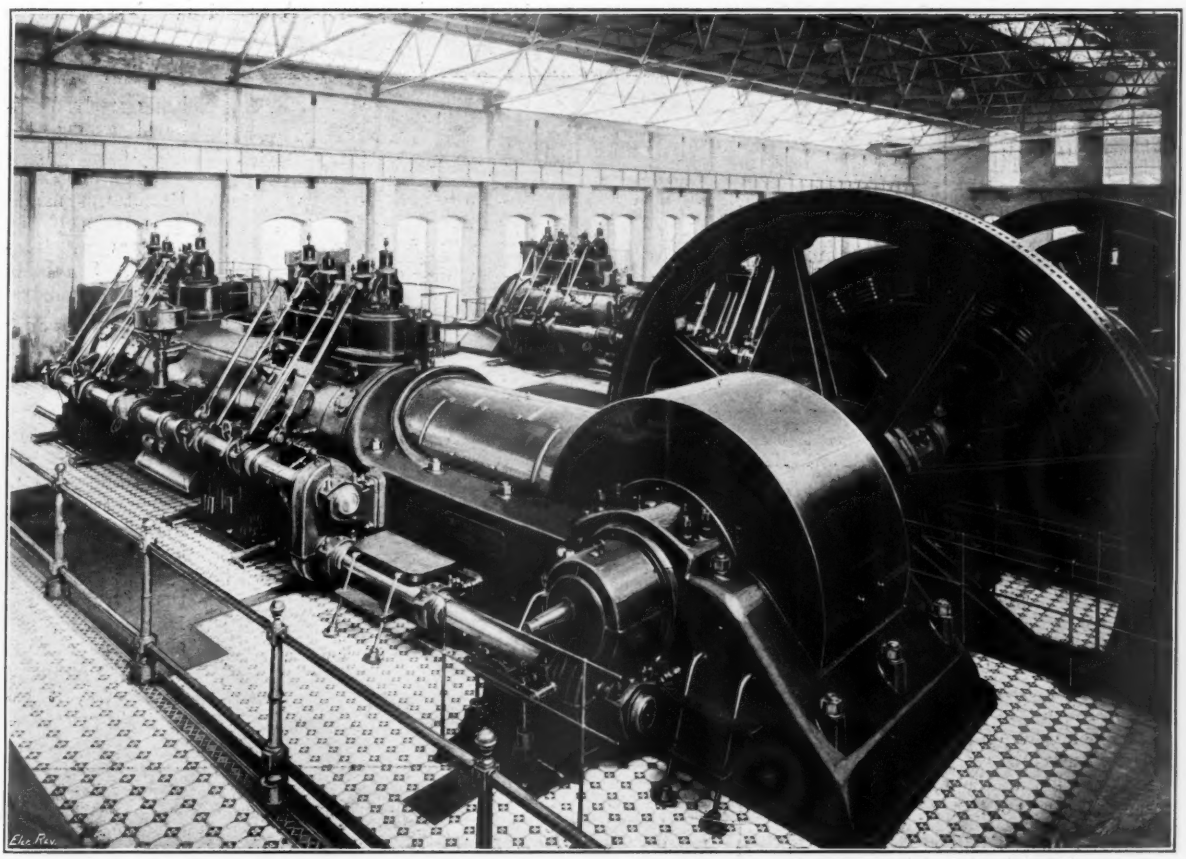
By far the finest installation, however, was found at the Hoesch Iron and Steel Works, Dortmund. Here there were ten or a dozen engines altogether, two being Siegener blowing engines of the two-cycle type, and the rest driving D.C. generators. The two Ehrhardt & Sehmer engines are each of 2,200 B.H.P., each having only two cylinders, in tandem, of 1,150 mm. diameter, 1,300 mm. stroke, and running at 94 R.P.M. Each of these engines—which are said to have the largest output on record per single cylinder—is coupled to an A.E.G.

24-pole dynamo, generating 3,050 amperes at 500-525 volts, or, say, 1,600 KW. Both sets were running perfectly, without noise or sparking, and with very little vibration, though the foundation rocked slightly. The engines, which are of the design shown in section on p. 690, are provided with eccentrics to work the mixing valve-gear, the other valves being worked by cams. Compressed air is used for starting the engines, this being admitted to one cylinder while the other is taking gas.

The other engines are of various makes and sizes—two with two cylinders each, by the Deutz Co., giving 215 KW., and four by Deutz and Klein Bros., giving 430 KW. each. But these were diminutive compared with the imposing dimensions of the big engines. The fact that, instead of continuing extensions with small engines and dynamos, large engines of Messrs. Ehrhardt & Sehmer's make driving generators of corresponding output have been preferred, clearly shows the confidence with which these sets are now regarded in Germany. We heard, in fact, that Messrs. Ehrhardt and Sehmer's pistons were being substituted for the original pattern in engines of certain other makers, owing to the continual breakage of the latter, while the E. & S. engines have gained a high reputation for freedom from breakdown. In one case we saw one of their engines dismantled; but this was due to a heated bearing, obviously due to the dust from the building operations in connection with the erection of additional sets close by, and in no way chargeable to the engine, which had been running day in, day out, without cause of complaint.

Our conclusion is that, with engines such as these available, there is no excuse for wasting blast-furnace or coke-oven gas. The cost of the plant is, of course, a consideration of fundamental importance, especially when steam plant is already installed; in this connection some figures which have been supplied to us by Mr. Leonard Andrews, and are reproduced elsewhere in this issue, will be found of interest.

Reference to the works of Messrs. Lahmeyer, and the electric winding plant, must be deferred to a later issue; but we take this opportunity of conveying to Mr. Andrews and the Key Engineering Co., to Messrs. Ehrhardt & Sehmer and their staff, and to Messrs. Lahmeyer, our thanks for their hospitality, and our cordial appreciation of the courteous treatment everywhere accorded to all members of the party.



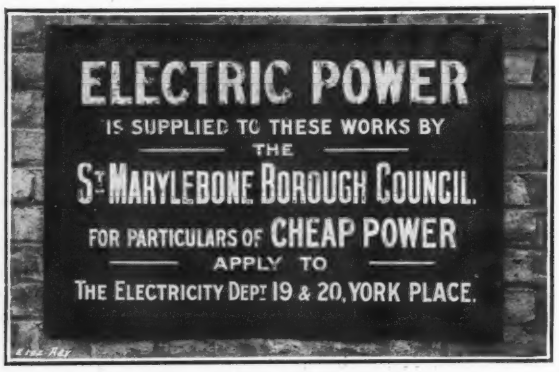
Hoesch Iron and Steel Works, Dortmund: Ehrhardt & Sehmer 2,200-h.p. Engines Driving A.E.G. Dynamos.

ELECTRICITY SUPPLY DEVELOPMENT IN ST. MARYLEBONE.

The electricity supply undertaking of the St. Marylebone Borough Council, which is the largest municipal system in London, was one of the first to apply organised methods to the commercial development of the business. The Borough Council completed taking over the supply from the Metropolitan Co. on March 31st, 1906, and towards the end of 1905 Mr. F. A. Wilkinson, the resident engineer and manager, initiated the Publicity Department. Work was commenced in a modest way, it being recognised that the system would have to be gradually evolved if it were to attain the desired end of exactly meeting the peculiar requirements of the district. The area was thoroughly explored with a view to ascertaining its worth from the development point of view, and this and the preliminary work of organising the department occupied the first few months of its existence. From the commencement of active canvassing the results were encouraging, and such as fully to warrant the expansion in work and staff which since that date has steadily taken place.

Before dealing with the methods employed, it will be desirable to give some data of the borough and the conditions and system of supply. The population in 1901 was 133,031; the area is about 1,506 acres; and the rateable value £1,957,505. High class residential and shop property forms by far the bulk of the district, and flats are extending

very rapidly, particularly in the North-West area. There are a number of small factories in the borough, and numerous private users of power for lifts and the like, but what is


ELECTRIC POWER
IS SUPPLIED TO THESE WORKS BY
THE
St. MARYLEBONE BOROUGH COUNCIL.
FOR PARTICULARS OF CHEAP POWER
APPLY TO
THE ELECTRICITY DEPT 19 & 20, YORK PLACE.

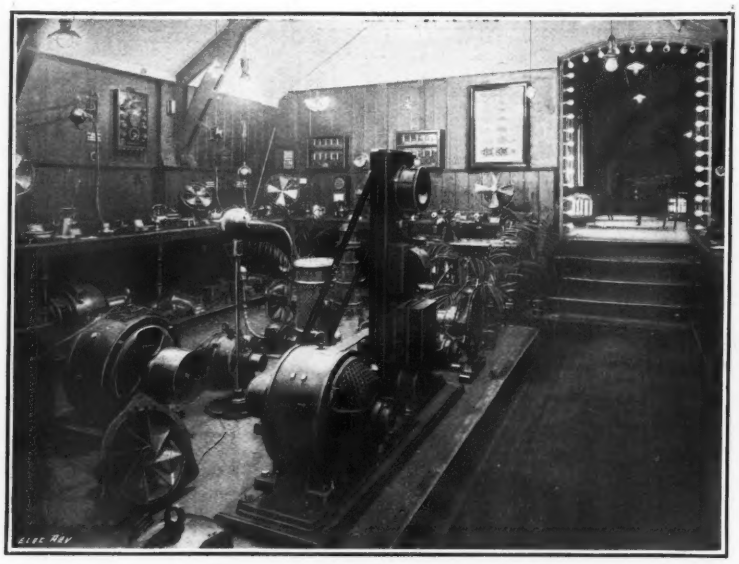
Advertising Sign.

usually considered large power work is entirely absent. On the other hand, there is undoubtedly scope for electric heating and cooking, since the initial expense of the apparatus is not prohibitive to the class resident in St. Marylebone.

The system of supply is 240-480 volts D.C., and the charges are 8d. and 1d. per unit on the maximum demand system for ordinary lighting; 2d. per unit for basements and day-load; 2d. and 1d. per unit on the maximum demand system for power, heating and cooking; and 2d. per unit for sign lighting. There is also a discount of 25 per cent. off the excess of each quarter's account over £50. Slot meters are in use, but at the present time the Council has no free wiring or hire schemes in operation. Both are contemplated, and there is no doubt that they will be of material assistance, especially in pushing electric heating and cooking.

The work of the Publicity Department is carried out under the superintendence of the commercial engineer, Mr. F. H. Davies, who is responsible to Mr. Wilkinson for its direction and the results obtained. The staff further includes a body of assistants paid on a flat salary basis and working each in his own area or upon a special subject. In this respect, however, the system is flexible, in order that each man's particular experience may be taken full advantage of. The area is primarily split up into districts, each of which is under the charge of an assistant whose duty is to look out for new work and attend to the wants of existing consumers, advising them on extensions, rearrangement of lighting and means of effecting economy. Important power work involving the estimation of costs and the rearrangement of machinery is handled by two assistant engineers, irrespective of the district in which it crops up. As the work is of a specialised nature, requiring in some cases considerable experience in motor driving, this has been found the best method of dealing with it. Complicated accounts adjustments are also handled separately, and claims or complaints out of the ordinary run are treated as a special and important side issue of the department. Negotiations with the largest existing and potential consumers (and there are several of the former whose annual accounts run well into four figures) are mostly carried out personally by Mr. Wilkinson with the general assistance of the department. Much work of this description is in hand at the present time, and it is anticipated that the next 12 months will see several particularly large consumers connected to the Council's mains.

The rate of 2d. per unit for sign lighting has been productive of excellent results, and one representative is engaged solely in pushing this class of work. Where necessary, the Department finds sites, and in every case renders all assistance in its power. A special pamphlet has been published upon the subject of Sign Lighting, and is being freely distributed among the local tradesmen.



St. Marylebone Electricity Department: Interior of Show-room.

The Electricity Department moved from temporary quarters in Manchester Street to the present offices in York Place, Baker Street, in April, 1906, and steps were at once taken to institute a showroom. Unfortunately, it was found impossible to arrange for a frontage on the street, but a large detached room at the rear of the premises has been adapted, and although scarcely as public as might be desired, it has

Interior of Show-room.

proved of considerable value. It is supplied with current at 100 and 240 volts, and contains some 20 motors ranging from ⅛ to 12 H.P.; several signs; 16 arc lamps of different sizes and types; examples of all the latest high-efficiency lamps, and a large assortment of radiators, convectors, irons, kettles, and like apparatus, all in working order. In addition, there is a complete X-ray outfit, which is shown in operation to any interested caller, and a quantity of medical and dental electrical apparatus, such as vibrators, drills, cauteries, &c. Against each article a small card is placed giving the consumption in units per hour, the better method of pence per hour being impossible, owing to the use of the maximum demand system of charging. The various publications of the department are distributed about the showroom benches, and a selection of them is kept in the inquiry office, through which the showroom is entered, and also in the cashier's office.

All the publicity literature has been specially got out and copyrighted, and it includes separate pamphlets dealing with Electric Light, Power, Heating and Cooking, Electric Signs, the Maximum Demand System of Charging, and Economy in the Use of Electric Light. There are also folders applying to special trades; a series of ten illustrated postcards dealing with sundry apparatus and used chiefly for acknowledging the receipt of consumers' letters; and a set of advertising slips for enclosure with the accounts. With a view to educating users of gas engines in the correct method of determining their power costs, a special folding card has recently been issued, scheduling on one side the items which go to make up the true cost of gas engine operation, and on the other, similar items for the electric motor. Gas engine users are encouraged to fill in the cost against each item detailed, and the department then fills in the other side, thus obtaining what is usually so difficult to arrive at, a correct comparison. To this end, data are accumulated wherever possible, so that the assistant dealing with the matter may speak with authority on any section of working costs. Each member of the staff engaged on canvassing work is provided with a loose-leaf book in which any interesting or valuable data is typed under main headings. The figures cover the whole field of power, lighting and heating, and are continually being added to.

A system has recently been introduced by aid of which it is hoped in time to obtain an accurate knowledge of every gas or steam engine plant in the borough. Such data is, of course, of considerable value in developing the power load, since it enables each instance to be thoroughly studied, and the necessary estimates to be prepared with more care than can be done at short notice. The collection of this information is part of every assistant's work, and when reported it is analysed and recorded in a special file.

Use is being made of enamelled iron advertising tablets, one of which is illustrated on the preceding page. A large number of buildings are being erected in the borough, and in the majority of the principal ones the department has been successful in securing the installation of temporary motors for hoists, mortar mixers, &c. One or more of these tablets, which measure 3 ft. by 2 ft., and are got out in white, green and red, are placed prominently on the hoardings, affording an excellent and inexpensive advertisement for electric power.

Newspaper advertising has, so far, not been employed, as it would probably be of little service in a borough like St. Marylebone. Circularising schemes and follow-up letters are also not favoured, for the same reason. They have been tried experimentally, but were found almost entirely unproductive. Practically all the energies of the department are centred on personal interviewing, backed up by the distribution of pamphlets suitably prepared for the particular class of work. This method has been found very successful and comparatively inexpensive. It is rendered thoroughly efficient by the system upon which the department is organised. Each assistant in charge of a district or speciality makes a daily typed report of his calls, the gist of which is transferred to a card index kept well up to date. When he deems it advisable to call again at any particular date beyond the near future this is noted in his report, and a special card is prepared and placed in another box with monthly guide cards. At the beginning of each month the cards which have been collected are distributed according to the initials they bear, and if necessary the daily reports are referred to for particulars of the case. A careful check is kept upon all application forms which leave the office, as it was found that many were not returned signed owing, perhaps, to some misapprehension or change of mind on the part of the prospective consumer. All applications for forms are now closely followed up, and the results have been very satisfactory. In a like manner it was found that many signed applications did not become connections, owing in several instances to difficulties over deposits, special offers from the gas company, &c. The same system of following up has, therefore, been instituted, and much leakage is now prevented. New buildings are carefully watched, a card index being kept of those of an important nature, either in course of erection or proposed. Every effort is made to get power circuits installed in new buildings, particularly in flats, where radiators are very popular and electric cooking undoubtedly has a future.

A very complete system of curve and book records of the progress of the undertaking is kept up by the department. When carried out systematically this involves little work and possesses considerable value, as it enables results to be traced and weak spots in the organisation or supply to be located. Each week an inclusive record of the connections, applications, and disconnections, is got out by the mains department, and from these data curves showing the progress in practically every direction are drawn. Despite the difficulties which surround such a task in a 20-year old supply that has changed hands, a very good idea has been obtained of what apparatus is connected to the mains, and these statistics being regularly posted it is easy to see at a glance what progress is being made, and where the greatest amount of energy should be expended. The mains department also keep a special yearly map record showing new consumers, old consumers reconnected, and extensions, in each street of the borough. This has been found very serviceable, as in a large undertaking it is practically impossible to carry in the head, or to keep written records of, the progress of the supply in various parts of the district. Both the accountants and the mains departments render valuable assistance by reporting any contemplated new or extension work they may hear of, and the inquiry office, which is part and parcel of the showroom, also acts as an important feeder to the department.

For obvious reasons it is impossible to deal with the various minutiæ of the system of which the above is but an outline. It is sufficient to say that the methods employed have been found productive of excellent results, and that without any clashing or duplication of the work. They are not a slavish copy of American methods, many of which would be highly unsuitable for St. Marylebone, but as before stated, they have been designed specially to meet the requirements of the borough. In view of the attention now being paid to the work, and in support of the contention that it is well worth undertaking, if properly carried out, the following data of actual results will be of interest:—

During the year ending March, 1907, the gross addition in equivalent 8-C.P. lamps was 70,334, amounting to an increase of 15·71 per cent. The H.P. of motors connected showed a net rise of 67·7 per cent.; and other power, including heating, cooking, and medical apparatus, a similar increase of 60 per cent. Splitting up this last item into its chief components, the following net KW. increases were obtained:—Radiators, 59 per cent.; fans, 57·1 per cent.; heating and cooking apparatus, 24·6 per cent.; medical and dental apparatus, 67·85 per cent.; automobile charging outfits, 112·9 per cent.

It is significant, also, that during the first three weeks of canvassing for electric signs at 2d. per unit the equivalent 8-C.P. lamps employed for this purpose were increased by approximately 175 per cent. Direct results are, of course, often difficult to trace, but there can be no question that the above figures, which are at least creditable for a 20-year-old supply, have been largely contributed to by the work of the Publicity Department.

Municipal Engineering.—The Chadwick medals in municipal hygiene and engineering at University College have been awarded to Messrs. N. G. Dunbar, W. D. Reynolds and J. R. Wade

CONTRACTS CLOSED.

(*Continued from page* 689.)

Grimsby.—The T.C. has accepted the tender of the Phœnix Dynamo Manufacturing Co., Ltd., for the supply of an engine and dynamo, at £2,383 and that of Messrs. Johnson and Phillips, Ltd., for cables, at £1,358.

India.—Messrs. W. T. Henley's Telegraph Works Co. are supplying the Bengal-Nagpur Railway with the necessary electric cables and wires; and Messrs. Santoni & Co. the arc lamps, with poles, &c. The General Electric Co. had a large order for the supply of telephone materials, of a value of about £600 f.o.b. at Liverpool; the Union Electric Co. for lamp-posts and accessories; and Messrs. J. Spencer & Co. for the supply of tubular iron poles, in connection with these installations.—*Indian Engineering.*

Johnson & Phillips's Contracts.—The following contracts have recently been secured by this firm:—

Glasgow.—For the Clyde Navigation, supply and erection of power and lighting cables for their Renfrew workshops.

London.—For the British Patent Perforated Paper Co., supply and erection of a D.C. dynamo.

Lewisham.—For the Guardians of the Lewisham Workhouse, new feeder cable.

Newcastle.—For the Lambton Collieries Co., for stranded aluminium cables.

Staines.—For the Linoleum Manufacturing Co., complete telephone equipment, including overhead wiring, &c.

Witney.—For the Electric Supply Co., a dynamo.

London.—Lambeth.—The B.C. General Purposes Committee reported having applied to the following firms to send in quotations for the supply of electric light fittings for the new municipal buildings:—Messrs. Starkie, Gardner & Co., Sugg & Co., Strode & Co., Veritys, Ltd., General Electric Co., F. & C. Osler, Ltd., and the Bromsgrove Guild. Designs were sent in by all the firms except Messrs. Starkie, Gardner & Co. and Messrs. Sugg and Co. The cost of the fittings suggested by the Bromsgrove Guild, and by Messrs. Osler, Ltd., considerably exceeded the cost of those for which Messrs. Strode, Veritys, Ltd., and the General Electric Co. sent in designs, and the sub-committee to whom the matter was referred decided personally to inspect the showrooms of these three last-named firms. After careful inspection and comparison of the designs and estimates of these, the Committee recommended that the quotation of the General Electric Co. to supply electric fittings for the new municipal buildings, except for the Council chamber and Council ante-room, at an estimated cost of £259 10s., be accepted; and that Messrs. Strode & Co. wire and fix such fittings, at £66.

Hackney.—The B.C. has accepted the tender of Silk & Sons, at £81 15s., for painting work at the generating station. 30 tenders were received, ranging from that accepted up to £171.

Luton.—The T.C. has accepted the tender of Messrs. Edward Rennis & Co., Ltd., for the supply of four additional mechanical stokers and compressed air furnaces for the electricity works.

Maidstone.—The T.C. has received the following tenders for the extension of the switchboard:—

Drake & Gorham, Ltd.	(accepted)	£169 10
Crompton & Co.		804 0
Veritys, Ltd.		212 0
Dick, Kerr & Co.		180 6
Siemens Bros. & Co.		179 10

For the supply of electrically-driven pumps at the sewage works the following tenders were received:—

Siemens Bros.	(accepted)	£1,963 9
Mather & Platt		2,655 0
Greenwood & Batley		2,404 7
Gwynnes, Ltd.		2,311 0
W. H. Allen & Co.		2,310 0
Penrose & Co.		2,291 10
Lancashire Dynamo Co.		2,284 5
Ernest Scott & Mountain		2,224 0
Electrical Co.		1,988 10
Johnson & Phillips		1,955 12
F. W. Brackett & Co.		1,917 7

For the supply of 20 flame arc lamps the tender of the Oliver Arc Lamp Co., Ltd., at £206, has been accepted.

Portsmouth.—The tender of Messrs. Grossmith & Co., of Southsea, has been accepted for the installation of electric light at the Empire Theatre, Portsmouth.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Messrs. Lord Bros. for installing the electric light at the Council offices (£75), the Town Hall (£108), and the Baths (£69).

Tonbridge.—The following are the results of tenders to the specification of electric light installation at Somerhill, Tonbridge, for Mr. O. d'Avigdor Goldsmid, issued by the consulting engineers, Messrs. Owen Lucas & Pyke, of Victoria Street, S.W.

Item 1.—Two Hornsby-Akroyd 28-B.H.P. oil engines and accessories.
Item 2.—Two 20-KW. dynamos, main switchboard and accessories.
Item 3.—Electrical Power Storage Co.'s battery of 110 W.S. 15 cells.
Item 4.—Mains and sub-mains.
Items 5 and 6.—Wiring of the house, out-buildings, &c.
Item 7.—Fixed sum for certain contingencies.

Item (1)	Item (2)	Item (3)	Item (4)	Item (5)	Item (6)	Item (7)	
£842	£513	£626	£732	£560	£465	£248	Strange & Sons, Ltd., Tunbridge. £4,086
832	467	575	538	513	471	248	H. M. Leaf, Victoria Street, S.W. £3,643
822	474	597	415	516	390	248	Seale, Austen and Barnes, Ltd., Tonbridge. £3,462
855	528	624	559	355	288	248	Belshaw & Co., Victoria Street, S.W. £3,457
860	516	540	540	430	305	248	Leo Sunderland & Co. Victoria Street, S.W. £3,490

Messrs. Leo Sunderland & Co.'s tender has been accepted.

West Ham.—The E.L. and Tramways Committee have provisionally accepted the following tenders for india-rubber-covered wires and cables:—

Garnett's Cable Co.—Association cable.
Pluttte, Scheele & Co.—Non-association cable.
India-Rubber, Gutta-Percha & Telegraph Works Co.—High-tension cable.

FORTHCOMING EVENTS.

To-day's Events (Friday, October 25th).—At 5 p.m. At Royal College of Science, Imperial Institute Road, S.W. Meeting of the Physical Society. "On the Use of Variable Mutual Inductances," by Mr. A Campbell; "On Magnetic Oscillators as Radiators in Wireless Telegraphy," by Dr. J. A. Fleming.

11 a.m. to 10 p.m.—"The Model Engineer" Scientific Exhibition, at the Royal Horticultural Hall. To close to-morrow.

At 7 p.m. Junior Institution of Engineers. Visit to "Model Engineer" Exhibition, Horticultural Hall, Vincent Square, S.W.

Saturday, October 26th.—At 2.30 p.m. Junior Institution of Engineers. Visit to Blackfriars Bridge widening works.

Tuesday, October 29th.—At 8 p.m., in the Library of the I.E.E. Meeting of the Faraday Society. Papers by Dr. B. D. Steele; F. E. Weston and H. R. Ellis; and Dr. F. M. Perkin and L. Pratt.

Wednesday, October 30th.—North of England Institute of Mining and Mechanical Engineers. Excursion to Cargo Fleet Ironworks for the inspection of blast-furnace plant, coal-washing plant, Kopper's coke ovens and by-product plant, electric generating plant, Talbot steel furnaces, rolling mills, &c.

NOTES.

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Local Section, Students).—Mr. J. Lawton Lovell, the hon. secretary of this Section, sends us the following list of arrangements made for the forthcoming session. The meetings are held at the Municipal School of Technology in Whitworth Street on Tuesday evenings.

1907. Meetings.
Nov. 5th.—Supper and Smoking Concert.
Nov. 19th.—L. J. Lepine, "Power for Works and Factories, with Costs."
Dec. 3rd.—E. P. Hill, B.Sc., Tech., "The Evolution of the Modern Switchboard."
Dec. 17th.—L. H. A. Carr, B.Sc., Tech., "Electricity and Matter."

1908.
Jan. 14th.—P. C. Jones, "Starters and Control Gear."
Jan. 28th.—W. D. Redfern, B.Sc., Tech., "The Design of Polyphase Induction Motors."
Feb. 11th.—W. Hanna, "Electrical Driving of Textile Mills."
Feb. 25th.—Discussion. Subject to be announced later.
March 10th.—A. E. Jepson, "Electrical Testing."
March 24th.—C. W. Crosbie, "Some Notes on Power Station Equipment and Design."
April 7th.—Annual General Meeting.

1907. Visits to Works.
Nov. 9th.—The Park Works of Messrs. Mather & Platt, Ltd.
Nov. 23rd.—The plant of the Mersey Railway, Birkenhead.
Dec. 14th.—The mill of Messrs. The Kearsley Spinning Co., Ltd., Stoneclough.

1908.
Jan. 11th.—The works of Messrs. Craven Bros., Ltd.
Jan. 25th.—The works of the National Gas Engine Co., Ashton-under-Lyne.
Feb. 8th.—The Lister Drive Generating Station of the Liverpool Corporation.
Feb. 22nd.—The works of Messrs. Ferranti, Ltd., Hollinwood.
March 7th.—To be announced later.
March 21st.—The works of Messrs. The General Electric Co., Ltd., Witton, Birmingham.
April 4th.—The works of Messrs. Browett, Lindley & Co., Ltd., Patricroft.

Institution of Electrical Engineers (Glasgow Section, Students).—At the first meeting of the session on Friday evening, Prof. Magnus Maclean gave an address on the testing of transformers.

Junior Institution of Engineers.—The annual general meeting of this Institution was held on Friday last; Mr. Lewis H. Rugg

the retiring chairman, presided at the commencement, and was succeeded by Mr. Frank R. Durham, elected at the meeting. The Council's annual report, which was presented, recorded a very satisfactory year of work. It was stated that the membership was now 967, as compared with 908 a year ago, and the accounts indicated that the Institution was in a sound financial condition. A paper on "The Economic Design of Hollow Shafts" was read by Prof. W. E. Lilly, D.Sc., of Dublin University. It described a number of original experiments on secondary flexure carried out by the author at Trinity College. It was announced that M. Gustave Canet, of Paris, the newly-elected President, would deliver his inaugural address on November 18th, taking for his subject, "The Latest Improvements in English and French Modern Artillery."

LIVERPOOL UNIVERSITY.—Under the arrangements for evening classes here, the first of a course of five lectures upon the "Generation and Distribution of Power," was delivered on Thursday, 17th inst., in the Walker Engineering Laboratories, by Prof. Watkinson.

ENGINEERING AND MACHINERY EXHIBITION AT OLYMPIA.—Mr. Percy Longmuir on October 16th gave to a crowded audience an interesting dissertation on "Tool Steel." He said that the crucible process, the product of which was usually known as "cast-steel," was undoubtedly *the* process for the production of high-grade tool steel. Of possible rivals in the future, there might be some chance for furnaces of the induction type, and the development of electric smelting was worth observation by those interested in tool steel. A knowledge of the properties of steel depends very largely on a knowledge of its constitution; by the aid of lantern slides showing the structure of different steels in various conditions the fundamental differences in constitution were clearly shown. The influence of special elements on ordinary steels was traced, and the valuable properties obtained were shown to be due to modification of structure and constitution.

On October 17th Prof. S. Herbert Cox lectured on the subject of "Metalliferous Mining." He observed that mining had now passed from the stage in which only the richer deposits could be worked, and that in a very primitive manner, to the handling of low-grade deposits on a large scale, utilising every mechanical appliance that could be devised. Hoisting had received great attention, and rope speeds from 1,000 to 1,500 ft. per minute were not uncommon. While the system of pumping with rods still held its own for vertical shafts, the modern high-speed differential pumps and high-lift centrifugal pumps were claiming a great deal of attention and doing good work. Ore dressing, moreover, was becoming more important, and devices were being introduced not only to separate heavy minerals from the lighter refuse, but also in many cases to separate minerals by magnetic machines.

How to Get Work.—This is a note for consulting engineers—of course others may read it too. An interesting letter appears in the last number of the *Architect*, under the title "How Architects Get Work," from the pen of a correspondent who has been successful as an architect, though he had no friends to "influence" work in his direction. His remarks read a little bit like self-praise, but that is our by-the-way; it cannot be other than a mistake on our part to regard them thus. He shows that one who adopts the ideal that good work is the only legitimate means of getting other work, can succeed in spite of all difficulties. We cannot refrain from quoting a few extracts from the letter, because we believe that they will also represent the sentiments of many an electrical or other consulting engineer, who finds himself too often like Mr. Micawber, and who is tempted to be discouraged. We are inclined to think that good work pays anybody in the long run, provided that there is more work to get, and not too many of us waiting to secure it. It may not be rewarded by an immediate rush of jobs, but there is at least one's own personal satisfaction and reputation to consider. The engineer who may have piled up huge fees by putting in indifferent and ill-considered work, while adding to his worldly wealth is also erecting a monumental pile of discredit which will make his name a by-word among his *confrères* or a rising generation. We shall be quite prepared to receive letters from some of our engineering readers who will be able to prove that *their* good work has *not* paid in the long run, or they may tell us stories of men who have succeeded in three stages (1) on, (2) honour, (3) honest. We believe it would relieve some of them to see these thoughts of theirs in print. But the theme is a big one, and at the moment we will be content with the reproduction of a few extracts from the *Architect* correspondent's epistle in praise of self, from which other Pharisees and some publicans may learn something that may be a help at a time when jobs are scarce and the Corrupt Practices Act is in force. There are engineers who "get on" because their *names* get known. There are others who get known, because their good work gets them "on." Given good work, "getting known" and "getting on" seem to mean pretty much the same thing. To add that the man who does good work "gets on" in the highest sense of the word, whether his doorstep be worn with the tread of clients or not, would savour perhaps too much of the schoolboy copy-book maxim order, but even this is a thing that engineers should think about sometimes.

"I am roundly upbraided for not 'mixing' in society so as to get more commissions; yet I go on, and shall go on, believing that as with the shoemaker, so with the architect. If the former makes a pair of shoes which are a perfect fit and a pleasure to wear, the wearer recommends him to other 'clients.' Likewise the architect who does a good work—putting his soul into it—gets recommended to other work. It is the only way.

"As regards my own practice, the aim which I have steadily kept before me *does* bring me work. It was thrown at me the other day 'that while my work was known, I was not known personally,' and it was explained to me that to be personally known brings work. Yet, within a few days of this utterance, I had a letter from an old client, for whom I had successfully carried out a difficult work, informing me that a possible client would like to see me in a distant town. Result—sketch plans made, approved, and within four weeks the excavations commenced for a building of six storeys covering 900 square metres.

"For the man who joins a club, becomes a Freemason, goes to afternoon teas, gets to 'know everybody' that he may rake in a commission or two, I have the profoundest contempt. I am ready to lend a hand to any practitioner who needs the help and sympathy of an older man, but to follow the dubious practice of using the occasion of social amenities to get work, I set down as reprehensible, if not improper, conduct on the part of an architect. If it be true, the one blot on the character of one of our finest architects, lately deceased, was that he said he 'got more commissions in a dress coat than in any other.' It was a paltry use to which to put a dress coat; the waiter in his dress coat accepting his tip is more honourable."

Mr. Lloyd-George and the Patents Act.—In the course of his speech to the Manchester Chamber of Commerce last week, the President of the Board of Trade urged that Chambers of Commerce should co-operate with the Government in making the Patents Act a success. According to the *Morning Post* report, he said that there "Was a good deal in it for the trade and commerce of this country. He had got out, so far as the resources of his department would allow, a list of the patents taken out in this country and worked abroad. If they looked at it they would be amazed. It was a big volume of hundreds of patents, some of them, no doubt, insignificant, some not very valuable, but some of enormous value, covering every branch of industry. It meant that every one of those patents registered here and worked abroad was excluding a valuable profitable British industry which would afford employment for a good many people in this country. To call that Free Trade was to libel a good cause. Therefore it was really worth while to make an effort to see that this Act was a reality, and not a sham. It was a reality as far as its powers were concerned. Whether it would be a reality in its operation would depend upon the amount of the co-operation between Chambers of Commerce and the Board of Trade. In the first place someone must bring the matter complained of to the cognisance of the Board of Trade, so that those who had been granted patents in this country and were working them abroad might be called upon to explain what adequate reason they had for so doing. He invited Chambers of Commerce to put themselves in communication with the Board of Trade on this subject."

Edison's Newest Battery.—Our sympathies are with Mr. Thomas A. Edison, who is once more accused of "inventing" marvels, including a system of house-building with reinforced concrete, and "a perfect electric storage battery." No particulars are to hand, but the statement is attributed to the inventor by the *Daily Mail* correspondent (who says he was anxious to ascertain "the exact truth") that "the horse is doomed." The battery will last for 50,000 miles, and when mounted on a truck will carry twice as much, travel twice as far, and occupy half as much space, as a horse and wagon. Mr. Edison is reported to have said that he expects to have his battery ready for the market by the end of the year. We are content to leave it at that; and the incident, having served for a two-days' wonder in the non-technical Press, may be regarded as closed.

Suicide at Kingston Electricity Works.—On Saturday last an inquest was held into the death of W. B. Brown, 56, a master carpenter, who, after making inquiries on Thursday last week as to which were the dangerous parts of the switchboard at the Kingston-on-Thames Corporation electric lighting station, deliberately took the first opportunity when the station foreman's back was turned of clutching the terminals of a main switch. The station foreman, seeing what had occurred, switched off the current, and Brown, who had been leaning forward against the board, fell down the steps dead. Mr. J. E. Edgcome, the borough electrical engineer, in his evidence, said that the parts of the board were well protected against accidental contact. Brown had no business at the works on that morning. He had been in the habit of doing carpenter's work at the station. Deceased had written a statement in his pocket-book showing his determination to end his life either in this way or at Brookwood. The medical evidence showed that death was due to heart failure caused by a 2,000-volt shock. Mr. G. S. Ram, representing the Home Office, in giving evidence, said that the danger spots were effectively guarded against accidental contact. A verdict of suicide during temporary insanity was returned by the jury, who also expressed the opinion that everything was done to ensure the safety of the employés at the works.

Electrical Duties on French Warships.—The question of the sub-division of electrical control on French warships is raised by M. Lussac in a recent issue of *L'Electricien*. It appears that all the battleships belonging to the programme fixed in 1900 are each equipped with four main dynamos of 100 KW. each and with two auxiliary dynamos of 50 KW. each. These make a total of 500 KW., which is utilised for lighting, gun and ammunition services, ventilation, &c. The six generators and the main switchboards are entrusted to an engineering officer, who has under his orders subordinate officers and sailor-mechanics, some of whom are skilled in electrical work. A second officer—the torpedo officer—attends to the network of cables and conductors between the main switchboard and the places of consumption and utilisation, including the number of approximately 1,300 incandescent lamps, the arc lamps, together

with the six projectors, and some small motors for ventilating and other purposes. The principal motors on board are those used for working the guns, and these are under the charge of a third officer, termed the gun officer. Other apparatus, such as turbines or electric pumps, workshop motors and a certain number of ventilators, are in the hands of the engineer officer who is in charge of the generators. M. Lussac submits that it is beyond question that the engineer officer and the gun officer have not at their disposal workmen who are competent to repair the apparatus, and they are therefore compelled to borrow the torpedo *personnel*, who are thus subject to three different managements. This situation of affairs is not limited to the 15,000-ton battleships, but is found on board all the other vessels of the fleet, and many protests are raised against this defiance of industrial principles. The parcelling out of the "electrical life" on board ship results in various errors and in a low efficiency. Motor commutators are neglected, the insulation of the appliances can only be followed with care by the torpedo staff, and the variety of men who operate the secondary switchboards leads to errors, and might be dangerous during evolutions. M. Lussac states that the torpedo officers, who receive special electrical training, do not wish to allow personal matters to interfere with the general interest, but the opinion is that they alone should play the true *rôle* of naval electricians in the sense of being heads of the generating plant, the distributing network and the electrical machinery and apparatus all over the warships.

Electro-Chemical Notes.—The Production of Phosphorus in the Electric Furnace.—Phosphorus was formerly produced from bones and other organic substances, and it is only recently that it has been extracted from mineral deposits. The mineral from which this element was first produced was rock phosphate, but apatite has been utilised in Europe, and quite recently wavellite in America. One of the most successful processes in use at the present day was introduced by Readman. In this, the phosphate is crushed and roasted, and then mixed with charcoal and silica, and supplied to a continuously operated electric furnace in a reducing atmosphere. Two carbon electrodes supply the current, which passes through the whole mixture, which acts as resistance material. Phosphorus begins to distill at 1,150° C., but requires a temperature of 1,500° to complete the process. The Lanch's method is now being operated by the American Phosphorus Co., of Philadelphia, by a process which is kept secret. As far as can be learned, however, it is similar to the above method, and is used for reducing wavellite. The escape of fumes is prevented by an outer lining of non-absorbent brick, and by a sealing device for all openings into the furnace, whereby the projecting flanges of the joints are enclosed in a moat of water. The furnace has an inner lining of carbon bricks which acts as one electrode, and one or more vertical carbon electrodes are used, which may be adjusted either to furnish a continuous current through the charge, or to produce with it an electric arc. Slag is drawn off every two or three hours, and the phosphorus fumes are condensed under water. Another type of furnace has recently been introduced by the Oldbury Electrochemical Co., which is a modification of the first mentioned above. In this the carbon electrodes are suspended vertically, and connected below by coal at the start, through which the current passes. After the charge melts, the slag forms on the top, and hereafter the current passes through this. Fusion is continuous, and from time to time the slag is tapped off so as not to expose the ends of the electrodes.—*E.M.I.*, Vol. 5, No. 10.

New Variety of Chromium.—During the last few years a new field of technical and purely scientific research has been opened out, due to the introduction of the electric furnace as an instrument of chemical manipulation, and as a consequence new products have been discovered—depending for their existence on the production of high temperature. By this means Moissan largely enriched the domain of electro-chemistry, and discovered among other facts that chromium prepared in the electric furnace is slightly soluble in molten copper. This has been further investigated in the present communication, and has led to the discovery of a new form of chromium (*Revue d'Electrochimie et d'Electrometallurgie*, Vol. I, Nos. 7 and 8). The initial method was to heat a mixture of copper and chromium boride in an electric furnace for a few minutes, and on cooling remove the excess of copper by means of nitric acid. The best result was obtained, however, in the following manner. Chromium was prepared by the aluminothermic method of Goldschmidt, or by reduction in the electric furnace, and was mixed with a large excess of copper in a magnesia crucible. The mass was then heated for a few minutes in an electric furnace, or for several hours in a blast furnace. On cooling, the melt was treated with nitric acid and finally washed with water, and there remained a metallic-looking, powdery residue of a substance which, on analysis, showed 90 per cent. chromium. This, on examination, was found to be a crystalline mass resembling ferns in appearance. The density is 7·1, and the substance is very active in its chemical reactions. On heating in air alone it burns with a bright flame, and is attacked even by nitrogen at a red heat. On dissolving in hydrochloric acid, a small residue of the oxide of chromium is left, which is sufficient to account for the entire impurity of the metal. Analysis showed that copper dissolved 1·6 per cent. of its weight of chromium, which, on cooling, separated in very small crystalline stars. The state of division is so minute, that water alone takes some of it up in the form of a fine suspension or a colloidal solution.

Production of Manganese.—In view of recent developments in metallurgical industries, manganese is assuming greater importance every day. The introduction of ferro-alloys, which were made possible when the importance of the electric reduction method was recognised, greatly increased the demand for manganese and caused the opening up of many new mineral centres. Not very many years ago almost the entire world's production of manganese ores came from a district of Russia called Tschatury. Since then the output from Russia alone has increased enormously, being 461,854 tons in 1904. Of recent years the United States have become serious rivals of Russia, and the output from this country is now nearly the same as from the older one. Of greatest importance, however, is the recent development in India. The first deposits were discovered in 1892 in the mountainous regions of Madras, and in 1905-6 there was exported through Bombay 4,721,435 cwt., valued at 3,555,554 rupees. Manganese ores have now been discovered in the neighbouring States, and as a consequence the Indian deposits have taken first place in importance. In Brazil the yield of ore has increased from 5,000 tons in 1895 to the enormous total of 224,377 tons in 1905. Greece rivals Brazil, and has increased its export from 10,000 tons in 1895 to 200,000 tons in 1903. The output from Germany is considerable, but in no wise approaches the above figures. In addition Spain, France and Turkey all produce small quantities of good ore.—*L'Elettricita.*

Compensation Case.—At the Wandsworth County Court on Monday, in the case C. F. Tanner *v.* The Underground Electric Railways Co. of London, Ltd., plaintiff applied to his Honour Judge Russell for a review of a compensation award made by that Court on July 6th, 1906.

Mr. J. M. Lickfold appeared for the applicant, and Mr. Scarlett was counsel for the respondents.

Mr. Lickfold said that prior to the award, which was for 12s. 4d. a week, an agreement had been filed under the Act whereby the applicant was paid 18s. 2d. a week, half his average earnings. He now asked for an increase to the full amount, which had been reduced on account of the man being taken back into the service of the company. The applicant was employed as mate to an electrical fitter, his wages being 36s. 4d. a week, and on January 16th, 1906, he met with a serious accident, and was taken to St. George's Hospital. He was at the time fixing cables to the roof of the engine room at Lot's Road, Chelsea, when he slipped, and, falling, clutched hold of some live wires. It was fortunate that he was not killed on the spot, but he fractured his hip, broke his thigh, and sustained concussion of the brain, as well as severe burns on both hands. After a while he was taken back, and the compensation was reduced to 12s. 4d. a week. In January last his wages were increased to 28s. for doing other and lighter work, and he (Mr. Lickfold) now asked his Honour to find that the object of the increase was to upset the compensation. On March 16th application was made to reduce the compensation to 8s. 4d. a week, on the ground that he was earning 28s. a week wages. At any rate, immediately afterwards he was discharged, and the company gave as a reason that the applicant insisted upon full compensation. After his dismissal he was paid 12s. 4d. a week, and he gave a receipt without prejudice, considering himself entitled to 18s. 4d.

The applicant entered the witness-box, but was not questioned.

Mr. Scarlett said his clients contended that the applicant was able to do work, and there was medical evidence on either side.

His Honour: Then a medical referee is the proper person to decide the case. In referring the case to Dr. Felix Kempster, his Honour said, "Can you agree to pay Dr. Kempster his fees?" He was aware that the Home Office paid him his special fee, and he got only an ordinary fee for reporting to the Court, and he would probably have to listen to a number of people and cross-examination. He should leave the whole case to Dr. Kempster.

Mr. Scarlett: We shall show that he was perfectly well a year after the accident.

Mr. Lickfold: Then the case goes to the medical referee for report, and then comes back to your Honour?

His Honour: This is wasting my time. I do not see there is any necessity to come back to me in the matter.

Mr. Scarlett: We will undertake to take up the award, and meanwhile we will go on paying the applicant compensation.

A Chinese Electric Pumping Plant.—In the report of the Chinese Engineering and Mining Co., it is stated that the erection of the electrical pumping and lighting plants at the Tongshan and Linsi Mines, which was proceeding at the date of the last report, has been retarded by various causes. The installation at Tongshan came into operation on April 16th last, and that at Linsi on June 25th last; they are proving entirely satisfactory.

Lindal Moor Mines.—We regret that in our last issue we incorrectly referred to Mr. Burrell as engineer-in-charge, he being, in fact, one of several shift engineers. We omitted also to mention the indebtedness of the visitors to Mr. C. E. Ray, manager to Messrs. Harrison, Ainslie & Co., for kind assistance in furnishing information as to the installation.

Electric Shock Fatality.—While endeavouring to free a banner which had become entangled in some electric wires over the roof of a New York hotel, one man was killed by electric shock, as he grasped the banner wire, another received a shock which sent him headlong into the street below, whence he was removed to hospital dying.

Tramwaymen Hoaxed.—An extraordinary story of a hoax comes from Tyneside, where the main features of the affair have been corroborated. Some time ago, it seems, a man came amongst the employés on the different electrical tramways in the district, and represented himself as a chief inspector of the Warwick tramways. He said a new section was being opened, and he was authorised to engage them on terms which were about ½d.

per hour better than those prevailing locally. A considerable number—between 15 and 20—men at South Shields accepted the offer, and were "engaged," and from Houghton-le-Spring, Howdon and Newcastle, others were obtained on similar promises. On the 18th inst. there was a farewell concert at South Shields, and the men were sent off in an enthusiastic manner. On arrival at Warwick it soon transpired that all the men had been hoaxed. Those who had money returned, those who had not were left stranded.

"Electricity" on Magnetism.—We cull the following from the correspondence columns of a recent number of *Electricity and Electrical Engineering*:—

"Mechanic.—The air between the magnet poles and the armature forms part of the path of the magnetic circuit, consequently its absence affects adversely the action of the machine, *since a vacuum will not allow magnetic lines of force to flow through it.*" (The italics are ours.)

One is led to think that our contemporary must have been obtaining recruits for its editorial section from the staffs of certain well-known halfpenny dailies.

A Gas Anti-Climax.—According to the *Daily News*, Prof. Vivian Lewis, speaking at the offices of the Gas Light and Coke Co. on Tuesday last, asserted that gas was superior to electric light in point of hygiene. This singular statement was explained by the rapid diffusion of the hot vitiated air through the plaster of the ceiling, cooler air rushing in to take its place. The result is said to be that the gas flame is a great engine of ventilation. The scientific limit of CO_2 in the atmosphere, beyond which danger to health is incurred, is given as 6 parts in 10,000; and Prof. Lewis claimed that at the breathing level in a gas-lighted room the amount of carbon dioxide present was 5 parts, while with electricity it was 6 parts per 10,000.

This looks pretty bad for electricity; were the proportion increased from 0·06 per cent. to 0·061 per cent., thus exceeding the limit of safety, what direful consequences might ensue! It would be interesting to know whether these tests were made in the same room, and on the same day, with the same number of persons present for the same length of time before the test. As they stand, we fear they are hardly convincing. And on the next occasion, perhaps, Prof. Lewis will let us know how much CO_2 was observed to be present in the unfortunate room above the plaster.

Financial Crisis in America.—In connection with the grave financial situation in the United States, it is reported from Pittsburg that receivers have been appointed by the United States Circuit Court for the Westinghouse Electric and Westinghouse Machine Companies, and the Security Investment Co. Petitions have also been filed for the appointment of receivers for the Nernst Lamp Co.

For Sale.—The receivers and liquidators of Brockie-Pell Arc Lamp, Ltd., are offering the property and assets of the company for sale by tender.

The Belfast Corporation are offering for sale in three lots the equipment of an artesian well.

At Manchester, on October 31st, Messrs. Percy Huddleston & Co. will offer a quantity of electrical apparatus for sale by auction.

Full particulars regarding the above announcements appear among the advertisements in to-day's issue.

Appointments Vacant.—Junior assistant engineer for the Leek U.D.C. electricity department (£65); assistant to borough electrical engineer at Eccles (£120); shift engineer for the Manchester electricity department (£150).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Battersea Borough Council received 137 applications for the position of shift engineer, at a commencing salary of £117 per annum. MR. JOHN CROWTHORNE MILTON, of Northampton, has been appointed.

MR. C. A. JAMES, of Wrexham, late of Southampton, has accepted an appointment in Taltal, Chile, for which port he sailed on September 26th. He takes up his new duties in November.

The *Australian Mining Standard* says that MR. EDGAR EVERETT STARK, who has been in temporary charge of the electric power and lighting undertaking of the Dunedin (N.Z.) City Council, has been permanently appointed to that position, at a salary of £700 per annum.

MR. J. CATHCART CHRISTIE, A.M.I.E.E., at present one of the senior electrical engineers for the Corporation of Glasgow, has been appointed chief engineer for the electrical works about to be constructed at Arbroath. Mr. Christie, who is 32 years of age, served his apprenticeship with Messrs. Douglas Fraser & Sons, Arbroath, and afterwards proceeded to Glasgow to the works of Sir William Arrol & Co., and was later with Messrs. Siemens Bros. and Co., of Woolwich, for three years. His next appointment was as assistant engineer at the Port Dundas power station under the Glasgow Corporation. He was shortly afterwards appointed senior engineer at the new power station of the same Corporation at St. Andrew's Cross. From thence he was promoted to be senior engineer, with full control at the Corporation's main station at Port Dundas, which is now one of the largest and best equipped stations in the country.

The Hammersmith B.C. has appointed MR. H. W. MARSHALL as canvasser and agent for the electricity department, at a weekly salary of £2 10s. There were 190 applicants.

MR. A. E. THOMAS, of the Wrexham Borough electricity staff, has been appointed chief clerk at the Partick electricity works, Glasgow.

The appointment of an electrical engineer to the Corporation of Limerick on Thursday last week, was the occasion of some exciting scenes. There were no fewer than 120 applications for the position, and the Committee had to sit three days to consider them. Finally, the Committee recommended the appointment of MR. PATRICK MACNAMARA, a Limerick man, a member of the Engineering Association of Ceylon. At the Corporation meeting, Councillor O'Brien moved an amendment to Mr. Macnamara's nomination, and a scene of disorder ensued necessitating the advent of the Mayor's serjeants to restore order. In the course of the squabble characteristic language was alleged to have been used, and one section was accused of wanting to elect an Englishman or a Scotchman in preference to a Limerick man. Ultimately, Mr. Macnamara's appointment was confirmed by 16 votes to 4, subject to his examination by an electrical expert.

General.—The Liverpool Workhouse Committee has decided to recommend to the Select Vestry the appointment of MR. H. GOBIE as engineer at the Brownlow Hill Workhouse. The salary is equal to £150 a year, and there were 274 applicants for the position. Mr. H. Gobie, who is at present in the service of the South Lancashire Tramways Co. at their generating station at Atherton, has had 17 years' experience as an electrical engineer.

MR. LEOLINE EDWARDS notifies that after 15 years in the electrical trade, having represented some of the largest firms, he is leaving for Australia on the 31st inst.

It is stated in the *Review of the River Plate* that on September 20th MR. A. B. COOK, M.Inst.M.E., foreign manager of the Brush Electrical Engineering Co., Ltd., left England for Buenos Ayres, to study the market there with a view to opening a branch. Mr. Cook is well-known in Argentina, as he was for many years assistant locomotive superintendent of the Central Argentine Railway.

A River Plate Exchange reports that Mr. Pedrialli, the legal representative of the Belga-Argentina Tramways, has formally notified the Municipal Commission of the appointment of MR. H. C. BOCQUET as manager of the company.

We regret to state that MR. R. BORLASE MATTHEWS is at present laid up with an attack of fever, and will not be able to return to business for a few weeks.

According to the *Australian Mining Standard*, MR. JOHN HENRY, M.A., B.E., Auckland (N.Z.), has been appointed head of the science side at the High School, Dawson City, Klondike, Canada. Mr. Henry recently occupied the position of instructor in mechanical and electrical engineering on the staff of the Auckland Technical College.

MR. J. R. CHAPMAN, chief engineer of the Underground Electric Railways Co. of London, Ltd., has been elected a director of the Metropolitan District Railway Co.

MR. P. MOTTRAM, who has had charge of the meter test-room at the Manchester works of the Westinghouse Co., has been transferred to London in connection with a contract which the firm has obtained in connection with the London County Council tramways.

MR. JOHN BELL, the newly appointed assistant lecturer and demonstrator in the Mechanical Engineering Department of the Northampton Polytechnic Institute, Clerkenwell, has already been for some time engaged in technical instruction, having for the past three years acted as assistant lecturer and instructor in a similar department at the City of Bradford Technical College. Before this, Mr. Bell was engaged in practical engineering work, comprising work in the drawing office, and fitting and erecting. He was a "Salt" scholar of the Salt Schools, Shipley, Yorks, and is a graduate of the Institution of Mechanical Engineers.

According to yesterday's *Times*, the Senate of the London University had before it on Wednesday an intimation from Sir ARTHUR RUCKER, D.Sc., F.R.S., the principal, that he desired to retire from that position in September, 1908, when he would attain the age of 60. The Senate passed a resolution placing on record its sincere regret at the announcement, and its appreciation of the great services he had rendered to the University, as principal, since its reconstitution.

Obituary.—Many of our readers will regret to learn of the death of MR. C. MONTGOMERY, who for rather over a quarter of a century faithfully and well represented the advertisement department of the ELECTRICAL REVIEW, latterly in and around London only. His health had been failing for several months, and although hope of his recovery was entertained so recently as the beginning of this week, he passed away peacefully on Tuesday last. The funeral takes place to-morrow at South Ealing Cemetery, 12.45 p.m.

A Canadian correspondent of the *Times* reports the death of COLONEL F. C. HENSHAW, president of the Canadian Marconi Wireless Telegraph Co

NEW COMPANIES REGISTERED.

Wolfram (Tungsten) Metal Filament Lamps, Ltd. (95,312).—This company was registered on October 12th, with a capital of £100,000 in £10 shares (7,500 "A" and 2,500 "B"), to adopt an agreement between the International Wolfram Gesellschaft, of Buda-Pesth, of the first part, the Deutsch Gasgluhlicht Aktien Gesellschaft (Auergesellschaft), of the second part, and this company, of the third part, and to carry on the business of manufacturers of and dealers in metal filament and other lamps and electrical goods, electricians, engineers, suppliers of electricity for light, heat, motive power or otherwise, &c. The first subscribers (each with one share) are:—H. Hirst, 71, Queen Victoria Street, E.C., electrical engineer; G. R. Fraser, Tower House, Slough, J.P.; F. Kallman, Berlin O. 17, Rotherstrasse 20, lawyer; R. Gunzburg, 181, Queen's Gate, S.W., merchant; D. McLagan, 71, Queen Victoria Street, E.C., electrical engineer; I. Salzman, 31, Lombard Street, E.C., merchant; and F. Samuelson, 46, Queen Victoria Street, E.C., solicitor. No initial public issue. The "A" shares take three-quarters and the "B" shares one quarter of the available profits. The number of directors is not to be less than seven or more than nine; the first are H. Hirst, J. Fraser, R. Gunzburg, F. Kallman, R. Feuer, S. Nathan, and H. R. von Kuh; any holder of 1,125 or more shares may appoint one director for each multiple of such number; H. Hirst and J. Fraser are nominated by the Robertson Electric Lamps, Ltd., F. Kallman, R. Gunzburg, S. Nathan and R. Feuer by the Deutsche Gasgluhlicht Aktiengesellschaft (Auergesellschaft), and H. R. von Kuh by the International Wolfram Aktiengesellschaft; qualification, 50 "A" or "B" shares. Registered office, 31, Copthall Avenue, E.C.

Brook, Hirst & Co., Ltd. (95,264).—This company was registered on October 16th, with a capital of £20,000 in £1 shares, to take over the business of electrical and mechanical engineers, manufacturers of electrical switches, switchgears and other electrical and mechanical appliances carried on by P. S. Brook and J. A. Hirst, as Brook, Hirst & Co., at the Northgate Electrical Works, Victoria Road, and at George Street, Chester, and to adopt an agreement with the said vendors. The first subscribers are:—J. A. Hirst, 3, Raymond Street, Chester, electrical engineer, with 100 shares; P. S. Brook, 11, Lumley Road, Chester, electrical engineer, 100 shares; J. Frater, Bank House, Hawarden, bank manager, 1 share; H. Sutcliffe, 2, Victoria Road, Chester, electrical engineer, 1 share; T. M. Dutton, 19, Newgate Street, Chester, solicitor, 1 share; A. H. Cartwright, 71, Faulkner Street, Hoole, Chester, electrical engineer, 1 share; and J. F. Eldridge, 15, Salisbury Street, Chester, electrical engineer, 1 share. No initial public issue. The number of directors is not to be less than two or more than five; the first are P. S. Brook and J. A. Hirst (managing directors); qualification, £100.

Electro-Medical Institute, Ltd. (95,317).—This company was registered on October 19th, with a capital of £2,000 in £1 shares, to take over as a going concern the business of an electro-medical specialist carried on by G. R. Peers, at 344, Bury New Road, Manchester, as the "Electro-Therapeutic Institute," and to adopt an agreement with the said vendor. The first subscribers (each with one share) are:—H. W. Calderbank, 78, King Street, Manchester, electrical engineer; G. R. Peers, 17, Snowdon Road, Eccles, Manchester, electrical engineer; J. Fogg, Clifton Villa, Mossley, Lancashire, mill manager; A. V. Ward, Fernside, Eccles, Lancashire, electrical engineer; G. H. Park, Winfield Terrace, Old Trafford, Manchester, engineer; W. P. Thurmann, 263, Oxford Road, Manchester, electrical engineer; and W. J. Herring, Merton, Maudeth Road, Withington, Manchester, electrical engineer. No initial public issue. Registered without articles of association.

A. F. Mander, Ltd. (95,261).—This company was registered on October 16th, with a capital of £1,000 in £1 shares, to acquire the business of an electrical engineer and contractor carried on by A. F. Mander at 258, Villa Cross, Aston Manor, and to carry on in the United Kingdom and elsewhere the business of electrical and general engineers, contractors, manufacturers of electrical and other fittings, &c. The first subscribers (each with one share) are:—S. Mander, 62, Victoria Road, Aston Manor, electrician; A. F. Mander, 62, Victoria Road, Aston Manor, electrical engineer; W. Franks, 198, Old Meeting Street, West Bromwich, electrical engineer; May Mander, 62, Victoria Road, Aston Manor, manageress; G. A. Goodway, 79, Soho Hill, Birmingham, certified accountant; A. G. Green, 72, Fentham Road, Birmingham, clerk; and A. E. Mitchell, Ashted Row, Birmingham, clerk. No initial public issue; registered without articles of association. Registered office, 258, Villa Cross, Aston Manor.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Phœnix Electric Heating Co., Ltd. (London) (88,751).—Issue on September 27th of £1,525 and October 11th of £100 6 per cent. debentures, making the whole of a series of £1,625 created by resolutions of same dates, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Van Raden & Co. (Electrical engineers, Coventry.) (78,383).—A debenture dated October 8th, 1907, to secure £1,250, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: V. W. Robinson, Park Hill, Kenilworth.

Fittings, Ltd. (Formerly "Art Fittings, Ltd.") (London).—(78,907).—A debenture, dated October 7th, 1907, to secure not more than £500, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holders: Drake & Gorham, Ltd., 66, Victoria Street, S.W.

Clarke, Steavenson & Co., Ltd. (57,821).—This company's annual return was filed on August 15th, when the entire capital of £3,000 in £1 shares had been taken up. £1 per share has been called up on 1,400, 15s. per share on 600 and 10s. per share on 1,000 shares and £2,350 has been received. Mortgages and charges: Nil.

Blackburn, Starling & Co., Ltd. (61,302).—This company's annual return was filed on September 7th, when 11,068 shares had been taken up out of a nominal capital of £12,000 in £1 shares. £7,168 has been received, and £3,900 is considered as paid. Mortgages and charges: Nil.

British Continental Electricity Co., Ltd. (57,008).—This company's annual return, made up to July 19th, was filed on September 4th; 1,000 preference and 994 ordinary shares have been taken up out of a nominal capital of £20,000 in 1,000 preference and 1,000 ordinary shares of £10 each. £10 per share has been called up on 790 preference and 844 ordinary, resulting in the receipt of £16,340. £3,600 is considered as paid on 210 preference and 150 ordinary. Mortgages and charges: Nil.

North Wales Power and Traction Co., Ltd. (78,193).—A trust deed dated July 31st, to secure £100,000 second mortgage debentures created July 25th, 1907, has been registered. Property charged: Certain lands and hereditaments, the company's electrical undertaking authorised by the Portmadoc, Beddgelert and South Snowdon Railway Act, 1901, and the North Wales Power Act, 1904, including the benefit of an agreement with the Aluminium Corporation, Ltd., £80,000 first mortgage debenture stock of the company, all the paid-up shares, debentures and debenture stock of the Portmadoc, Beddgelert and South Snowdon Railway Co., all debentures and debenture stock of the North Wales Narrow Gauge Railways Co. acquired or to be acquired by this company pursuant to certain agreements, and the company's general assets, present and future, including uncalled capital. Trustees: J. Tomkinson, M.P., of Willington Hall, Tarporley, Ches., and R. H. Guild, 29, St. Andrew Square, Edinburgh.

CITY NOTES.

Edison and Swan United Electric Light Co., Ltd.

The twenty-fourth ordinary general meeting of this company was held on Thursday of last week at Winchester House, Old Broad Street, Mr. H. Wolfenden presiding.

In moving the adoption of the report (see Electrical Review October 11th, page 627), the Chairman said he ventured to think they might congratulate themselves upon the results of the past year's trading. Although a profit of only £500 had been made over the preceding year, they must remember that that was made in the face of keen competition for the manufactured articles and high prices for the raw materials. The quality of the production had been maintained, and they strove by that method of business to retain their customers. The question of metallic filament lamps was a prominent one at the present moment, and the company had not lost sight of the matter. Turning to the accounts, the net revenue account showed a balance brought forward from profit and loss account of £54,236, an increase of £526. On the other hand, debenture interest had absorbed £16,390, being £340 less than the previous year. The depreciation on freehold and leasehold property, plant, tools, stock and reserves altogether amounted practically to the same figure as before. The amount allowed for depreciation was 8 per cent. They had placed £7,500 to the general reserve, which was started last year, making that item £12,500. The net balance available for distribution was £16,514, to which had to be added the balance brought forward of £9,006, making a total of £25,521. They proposed out of that sum a payment on the "A" shares of 4½ per cent., the same as last year, being 2s. 6d. per share on the partly-paid shares, and 4s. 2d. per share on the fully-paid shares, which would absorb £15,978, leaving a carry forward of £9,543, being £537 in excess of last year. As to the balance-sheet, the share capital remained the same as before, but there was a reduction in the debenture stock of £6,100, owing to the purchase and cancelling of £1,600 4 per cent. stock, and £4,500 5 per cent. stock. The average prices paid were £86 8s. for the 4 per cent., and £90 16s. 5d. for the 5 per cent. stock; the profit on the purchases had been placed to the reserve against stocks. Sundry creditors and credit balances were down by £3,917, and the smallness of the sum owed by them—£25,259—indicated considerable financial strength. The Altrincham Electric Supply Co. was going strong; after making provision for depreciation, the ordinary shareholders had received a dividend of 5 per cent. for the year 1906, and there was a probability of that rate being exceeded in the current year. Freehold and leasehold property was down by £3,505, being the £4,000 written off for depreciation, less new buildings added at a cost of £495. Stocks and plant together were up £1,889, and the explanation was that at the end of their financial year they held a heavy stock of raw materials, which had been bought at advantageous prices. They had added during the year a certain amount of new and additional machinery, the larger part of the expenditure being incurred in connection with the electrification of their works at Ponder's End. The contract was entered into in 1906, and the work had been carried out during the year under review. The cost of the work had been debited to capital, but that account had not yet been credited with the value of the plant displaced by the alterations. That plant had been mainly realised since June 30th, and would figure in the accounts for 1907. The net capital difference would not be great, and they believed they would derive economy in the working of the machinery, and so far that had been the case.

Mr. Ellier Clarke seconded the motion, and the report was adopted.

Monte Video Telephone Co., Ltd.

The annual meeting was held on Tuesday at Winchester House Mr. W. F. Jones presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, October 18th, page 663), said that last year he referred to the steady increase of their business since 1898, and to the net profits, and as they would see from the report there continued to be ample reason for congratulation in both respects. With the increase of the dividend on the ordinary shares from 5 per cent. to 6 per cent., and the placing to their reserve and the carrying forward of larger sums than before, they showed a still

further improved condition of things. It might be thought that a larger dividend than 6 per cent. might have been recommended, but the advisability of increasing their reserves was such that they were satisfied that a continuance of that policy would be supported. The large capital expenditure on renewals and extension of plant, which they had for a number of years been anticipating, had not been called for, owing to their not having obtained permission for laying down an underground system. Their efforts to obtain such permission had been continuous, and they were still hopeful, as the advantages of such a system to the public were so great that they would shortly prove successful. The policy of increasing the reserves would then be of material assistance in obtaining the additional capital which would be required. In anticipation of an underground plant they obtained in February last from the United River Plate Telephone Co., the services of Mr. H. Planchon, a telephone expert of acknowledged ability and experience, who was making an examination and report on their existing plant and the changes that would be necessary and advisable. Mr. Planchon's examination was very comprehensive and thorough, and they were assured his report would prove of great value. They had taken advantage of a visit now being made to the River Plate by Sir J. Gavey, late chief engineer to the Post Office, to obtain from him a general report on their plant and business, which would also be of great advantage in determining the character and details of the projected new capital expenditure. For some time it had been thought desirable that Mr. Powers, their general manager, should visit Europe and the United States in order to become more familiar with the latter-day developments in telephony. After 18 years' absence, most of the time in their service, there was much information of importance to the company to be acquired both in Europe and America, and they were confident of the good results from the visit he had recently made. During the past year they suffered, fortunately not to a serious extent, through the strike fever, from which, it seemed, no part of the civilised world could be considered altogether free. They were satisfied that, in their case, the matter was admirably handled by Mr. Powers, and, they believed, in such a manner that there would be little fear of anything of the kind occurring again for a considerable period. The company had made use of the offices of the River Plate Co. for a number of years, and had had the same secretary, but the increase of the business of both companies had been such that that arrangement was no longer convenient, and on the 1st inst. they moved into new offices at Dashwood House, and appointed a new secretary. They were particularly loth to lose Mr. David Smith, who, during his connection with them, had acquired a thorough grasp of the business, and proved himself of invaluable service. They were fortunate, however, in securing as secretary, Mr. R. H. Rivers, who had also been connected with the River Plate Co., and for several years associated with their books and accounts under Mr. Smith. There did not appear much in the accounts that required comment. The balance-sheet showed that the capital, £159,172, remained the same, and the capital expenditure for the year £5,000, which for many years past had been met entirely from revenue, was the same as the previous year. The reserve fund showed an increase of £5,000, and the reserve for renewal of plant £4,000. With the amount now placed to the credit of these accounts, their combined reserves would be £74,500, equal to one-half of the capital. Investments in securities were increased by £3,000 and amounted to £12,600, and the present market value of those securities was £1,000 more than the figure at which they stood in the books. Sundry debtors were £1,500 more than last year, and bills receivable were also £1,500 more. Other differences were slight. The profit and loss account showed an increase in total expenses of £1,000, and an increase in receipts of £4,100. By the appropriation account it would be seen that they placed £11,000 to reserves, which was £2,000 more than a year ago, and recommended, after paying the balance dividend on the preferred shares, a final dividend on the ordinary shares of 4 per cent., making 6 per cent. for the year, and carrying forward £3,081.

Mr. C. Lock seconded the adoption of the report.

Replying to a question, the Chairman said it was impossible to give a figure as to the probable cost of installing an underground system, because the city was constantly growing.

The report was carried, and subsequently votes of thanks were passed to Mr. Powers, the manager, to Senor Fernandez Garcia, who was in charge during Mr. Power's absence, and to Mr. Smith, the late secretary.

Mr. Smith promised that he would in the future do anything he could to further the company's interests.

Western Telegraph Co., Ltd.

The directors' report for the half-year ended June 30th states that the revenue for this period amounted to £325,687 and the working expenses to £113,886. After providing £16,000 for debenture stock interest, and £4,226 for income-tax, there remains a balance of £191,575; to this is added the sum of £8,461 brought forward from December 31st last, making a total of £20,036. A quarterly interim dividend, amounting to £31,190, has been paid, £85,000 tranferred to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund. The directors recommend the declaration of a final dividend of 3s. per share, making with the interim dividends, a total dividend of 6 per cent. for the year, and also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,983, leaving a balance of £6,864 to be carried forward. The dividend and bonus will be payable on October 31st.

Richardsons, Westgarth & Co., Ltd.—The report for year ended August, 1907, states that the profits for the year amount to £66,374, plus £7,331 brought forward. The directors recommend a dividend of 4 per cent. on the ordinary shares, setting aside for depreciation £12,500, and leaving to be carried forward £7,955. The Hartlepool, Middlesbrough and Sunderland works have been kept fairly well employed, but prices of materials have remained abnormally high and keenly competitive prices have been relatively low. Considerable delay has occurred through sectional strikes in the shipyards, and it will be of material gain to all concerned if the agreement now being considered by the Shipbuilders' Federation and the Boilermakers' Society is carried through, and these wasteful stoppages are obviated in the future. The unreasonably high prices of copper and tin have again materially affected the manufacturing profits. The turbine department continues to be fairly well supplied with orders. The directors regret having to recommend a reduction of the ordinary dividend to 4 per cent. per annum, but the amount of orders on hand at the present date considerably exceeds that of the corresponding period of last year, and exceeds £520,000.

Liberian Rubber Corporation, Ltd.—The report to December 31st, 1906, shows a loss on the first year's trading, but the directors state that this cannot justly be regarded as seriously disappointing when due consideration is given to the facts of the establishment of new stations, the opening up of new areas for exploitation, and the many outlays attendant upon the establishment of a practically new industry amongst the aboriginal natives. In spite of unforeseen drawbacks, very considerable progress has been made in the development of the rubber industry of Liberia, and the figures of this year show a handsome increase upon those now submitted. In 1906 the total rubber output of the company was 116,025 lb. avoirdupois, and that of the merchants was 10,380 lb., making a total of 126,405 lb. The company's output for 1907 promises to be at least double that of 1906. The company has established 30 stations and sub-stations in Liberia, but has at present reduced these to 26.

Cuba Submarine Telegraph Co., Ltd. — The directors' report for the half-year ending June 30th, states that the total receipts of the six months were £24,756, and the expenses £6,572, leaving a balance of £18,184, to which has to be added £6,791, brought forward, giving a total of £24,975. £5,676 has been placed to the reserve, against loss on investments, and £5,000 added to the reserve fund, which now stands at £103,000. The dividend on the preference shares will absorb £3,000, and leave £11,300, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax; the balance, £6,500 being carried forward. The cables continue in good working order.

Metallic Seamless Tube Co., Ltd.—The report for the year ended June 30th, 1907, shows a net profit, after providing for depreciation on plant and machinery, &c., of £2,309, plus a balance brought forward of £2,603. A dividend of 5 per cent. on the ordinary shares, free of income-tax is recommended, leaving £3.683 to carry forward.

Montreal Light, Heat and Power Co.—This company has declared a dividend of 1½ per cent. for the quarter ending October 31st.

Parsons Marine Steam Turbine Co.—During the year ended June 30th, this company's works were fully employed, and the resultant profit on manufacturing and from royalties, &c., after providing for depreciation on buildings, plant, machinery, &c., was £31,074, plus £4,947 brought forward. A dividend of 10 per cent. per annum, and a bonus of 2½ per cent. are to be paid, leaving £11,133 to be carried forward. The *Morning Post* says that practical effect is now being given to the proposal made some years ago by Mr. Parsons to combine low pressure turbines with reciprocating engines in vessels of moderate speed, in order to secure increased economy of steam and coal.

Stock Exchange Notice.—The Committee have ordered the undermentioned to be quoted in the Official List:—

Sumatra Para Rubber Plantation, Ltd.—50,000 shares of £1 each, fully paid, Nos. 1 to 50,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended September 27th, 1907, were 592,464, compared with 458,373 in the corresponding four weeks of 1906.

Highlands and Lowlands Para Rubber Co.—An interim dividend of 5 per cent. is declared.

Prospectus.—*Lanadron Rubber Estates, Ltd.*—This company which has been formed, with a capital of £320,000, to amalgamate a number of rubber estates in Johore, Malay Peninsula, has been before the public with an issue of shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Oct. 16	2,757	+ 179	20	30,761	— 1,487	14·4	..
Ayr	,, 19	420	..	28	8,890	— 198	8	..
Bath	,, 19	1,512	— 112	42	33,928	— 1,494	13	..
Belfast	,, 18	7,325	+ 482	29	107,943	+ 7,154	36	..
Birkenhead	,, 20	2,115	— 23	28	31,276	— 463	13·52	..
Birmingham Corp.	,, 19	12,781	..	29	177,256	..	56·54	..
†Blackburn	,, 16	2,197	+ 151	29½	33,666	+ 2,006	14·13	..
Blackpool Corp.	,, 17	1,671	+ 227	..	43,922	— 1,511	11·87	..
,, —Fleetw'd.	,, 19	908	— 18	15	20,737	— 1,171	8·25	..
Bolton	,, 20	4,475	+ 259	29	67,546	+ 3,942	26	..
Bournemouth	,, 16	2,993	— 11	28½	53,827	+ 968	21·5	2½
Bradford	,, 19	9,374	+ 536	29	138,228	+ 2,150	54	1
Brighton	,, 20	1,717	— 118	29	29,121	— 2,865	9·5	..
Bristol	,, 18	10,114	— 74	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 11	488	— 2	40	9,022	— 65	3·65	..
Barnsley	,, 11	352	+ 23	,,	9,796	+ 97	..	..
Barrow	,, 11	518	— 82	,,	10,616	— 252	5·87	..
Cavehill	,, 11	171	+ 9	,,	3,567	— 13½	..	..
Devonport	,, 11	968	— 40	,,	18,819	— 194	8·85	..
Gateshead	,, 11	2,129	+ 55	,,	40,729	+ 964	11·25	..
Gravesend	,, 11	529	+ 10	,,	10,097	— 144	6·5	..
Greenock	,, 11	1,401	+ 52	,,	27,058	— 947	7·25	..
Hartlepool	,, 11	603	— 10	,,	11,957	— 648	6·72	..
Kidderminster	,, 11	233	+ 24	,,	5,010	— 123	..	..
Leamington	,, 11	392	+ 14	,,	6,656	— 684	3	..
Merthyr	,, 11	457	+ 15	,,	8,542	+ 430	2·9	..
Metropolitan	,, 11	10,069	+3,872	,,	189,768	+47,866	22	..
Middleton	,, 11	720	+ 26	,,	14,557	— 115	8·5	..
Mid. Joint Com'tee	,, 11	13,420	+ 240	,,	235,580	+ 2,555	9·18	..
Oldham—Ashton	,, 11	1,267	+ 24	,,	24,646	+ 1,205	5·31	..
Peterborough	,, 11	346	+ 15	,,	5,290	— 233	29	..
Potteries	,, 11	3,967	— 20	,,	75,841	+ 2,165	2·75	..
Rothesay	,, 11	226	+ 218	,,	10,020	— 518	3·17	..
Southport	,, 11	566	+ 1	,,	12,645	— 618	..	..
S. Metropolitan	,, 11	1,700	..	,,	33,248	..	5·5	..
Swansea	,, 11	2,170	+ 371	,,	37,660	+ 2,779	3·75	..
Tynemouth	,, 11	448	— 11	,,	10,447	— 742	3	..
Weston-s-Mare	,, 9	248	— 10	,,	6,712	— 461	5·75	..
†Worcester	,, 11	618	+ 25	,,	11,739	— 194	..	..
Wrexham	,, 11	216	— 17	,,	4,207	— 83	17	..
Yorks. Wool. Dist.	,, 11	1,823	— 44	,,	33,173	+ 900	..	..
Miscellaneous	,, 11	445	— 11	,,	9,145	— 190	7·5	..
Burnley	,, 19	2,454	+ 47	..	..	..	11	2
Burton-on-Trent	,, 20	570	— 22	29	8,675	— 420	10·5	..
Bury	,, 18	2,255	..	28	32,054	..	15·87	..
†Cardiff	,, 19	4,187	+ 116	29	64,473	+ 1,719	..	..
Carlisle	,, 19	281	+ 8	42	7,400	— 528	13·16	..
Chatham and Dist.	,, 17	1,443	— 174	42	30,649	— 1,375	9·69	..
†Cork	,, 17	899	— 71	42	19,809	— 798	12	·75
Croydon	,, 18	2,769	— 154	29	42,653	— 1,998	..	..
Darlington	,, 19	431	+ 14	29	6,246	— 56	4·36	..
Darwen	,, 18	509	— 18	29	7,549	— 33	4·75	..
Dover	,, 19	425	— 52	29	7,287	— 986	54·25	5·5
Dublin	,, 18	12,511	+2,860	..	115,710	+26,551	13	..
Dundee	,, 16	2,445	+ 142	22	25,754	+ 628	7·75	..
East Ham	,, 19	1,778	+ 7	29	27,158	— 262	4·75	·5
Exeter	,, 18	571	— 80	29	9,757	+ 656	39·75	5
Glasgow	,, 19	36,596	+2,866	30	357,592	+ 8,740	..	..
Hastings	,, 17	1,876	..	..	..	..	28	..
Huddersfield	,, 5	3,618	+ 51	27	44,196	+ 1,986	13	..
Hull	,, 5	4,858	+ 246	26	64,990	+ 3,308	3·5	..
Ilkeston	,, 2	301	+ 27	27	3,988	+ 211	10·5	..
Ipswich	,, 19	747	— 35	29	12,710	— 952	4·25	..
Isle of Thanet	,, 19	804	— 71	42	29,492	— 462	11	..
Kilmarnock	,, 19	310	— 4	22	5,691	— 97	4·25	..
Lan'kshire Trm. Co.	,, 3	2,826	+ 842	40	47,488	+12,128	15·82	3·26
Lancashire United	,, 2	2,790	+ 363	40	51,026	+12,687	39	1
Leeds	,, 19	13,347	+ 796	29	193,306	+ 8,174	51·12	..
Leicester	,, 5	4,449	— 23	..	..	..	6	..
Leith	,, 19	1,066	+ 65	24½	12,379	— 1	104	..
Liverpool	,, 12	22,747	+ 67	41	449,614	+ 7,554	115·5	9·88
†L.C.C.	,, 12	64,723	+10,672	28	883,820	+145,412	..	..
London United	,, 4	14,331	+1,669	..	265,008	+11,515	3·5	..
†Lowestoft	,, 5	227	+ 4	..	..	..	86	11
Manchester	,, 19	30,058	+1,595	29	436,843	+31,775	..	..
Newcastle	,, 19	8,349	— 77	29	119,811	+ 232	14·5	..
Newport	,, 19	1,274	+ 27	29	20,733	+ 1,682	5·5	..
Northampton	,, 4	906	— 33	29½	19,184	— 556	23·75	..
Oldham	,, 20	3,986	+ 257	30	59,154	+ 3,668	5	1·75
Pontypridd	,, 5	557	+ 215	27	7,356	+ 2,602	14·5	..
Portsmouth	,, 19	3,468	— 31	29	62,462	— 2,081	..	..
Preston	,, 2	1,524	+ 22	..	..	..	13·25	..
Reading	,, 17	1,267	— 39	23½	18,357	— 746	10	·66
Rotherham	,, 3	1,287	+ 247	26½	16,804	+ 2,620	38·9	..
Salford	,, 21	9,281	+ 251	29	138,295	+ 3,732	35·75	..
Sheffield	,, 20	11,236	+ 426	30	167,805	+ 7,410	..	..
Southampton	,, 16	3,050	+ 158	28	30,623	+ 1,904	..	..
Southend-on-Sea	,, 2	955	+ 124	27	12,787	— 171	..	..
Sunderland	,, 6	3,624	— 126	27	39,342	— 550	4·4	..
Swindon	,, 2	369	+ 10	..	..	..	8·87	..
Tyneside	,, 2	911	— 9	40	18,642	+ 787	8·72	·22
Wallasey	,, 5	1,716	+ 51	27	24,073	+ 565	9	..
Walthamstow	,, 19	1,104	+ 94	29	18,997	+ 251	14·7	..
West Ham	,, 17	4,483	— 189	29	68,663	+ 818	12·5	..
Wolverhampton	,, 2	1,752	+ 87	26	23,820	..	..	..
Yorks. W. Riding	,, 20	2,308	+ 630	42	48,999	+12,495	4·25	1
Baker St.-Waterloo	,, 5	4,825	+1,500	14	31,960	— 2,461	6	..
Cen. London Rly.	,, 19	11,156	—1,884	16	79,047	..	7·75	..
Char. +, Eus. Hamp.	,, 5	5,190	..	14	35,195	+ 7,076	6 3	1·05
City & S. Lon. Rly.	,, 6	6,070	+ 469	14	42,360	+ 179	7	..
Dublin-Lucan Rly.	,, 4	292	+ 23	14	2,184	— 510	3·5	..
G.N. and City Rly.	,, 19	3,441	— 206	16	25,784	..	9	..
G.N., P'dy. & Brmp.	,, 5	8,420	+ 260	14	54,745	+ 1,387	6·8	4·3
L'pool Overh'd Rly.	,, 20	2,856	+ 26	16	25,791	+ 2,110	4 5	..
Mersey Railway	,, 19	3,727	+ 242	16	29,256	+ 5,719	94·5	..
Metropolitan Rly.	,, 20	31,149	+ 448	16	287,542	— 565	24	..
Met. District Rly.	,, 19	16,664	+ 337	16	118,478	+ 67,393	48	..
Anglo-Argentine	,, 21	35,617	+2,660	42	696,761	+ 3,668	19·2	·56
§Auckland	Sept. 18	9,905	+ 195	36	93,674	..	..	..
§Brisbane	Sept.	12,660	+1,081	..	..	..	..	..
§Brit. Columbia Rly.	August	31,400	+8,800	9	62,600	+18,250	..	..
Calcutta	Oct. 5	6,714	+ 986	..	..	..	..	..
§Cape Electric T. Ld.	August	9,240	..	..	..	..	..	..
§Geneva	,,	9,579	+ 627	..	..	..	20·5	..
§Kalgoorlie, W.A.	,,	4,549	..	35	31,955	..	..	..
Madras	Sept. 30	1,106	+ 295	39	20,627	+ 3,559	19·76	2·25
§Lisbon	May	898	..	..	..	..	..	..
Perth (W.A.)	Oct. 18	2,684	— 194	42	58,670	— 2,114	25·48	·22
†Buenos A. & Belgro.	,, 21	4,006	+ 190	42	161,014	+ 8,987	..	..

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

Taken all round, markets in the Stock Exchange are in a somewhat better condition than they were at this time last week. Brisk rallies in Consols and other gilt-edged securities have done a little towards helping in the restoration of the public confidence which is so badly needed to infuse a little more cheerfulness into quotations.

The course of trade throughout the country is reported to be slackening; and if his be so, it will mean the diversion of capital to Stock Exchange channels. Trade prosperity, of course, means that money is required for the development of the industries affected. As soon as trade falls off, more profitable employment can be found in the Stock Exchange for cash, and consequently business in the House improves.

That there is less money being made in the iron and steel trades seems to be manifested by the steady sales of shares in companies directly or closely connected with these industries. Prices have given way to a noticeable extent during the month which is drawing to a close, and the realisations are said to be not wholly due to the fears of the labour agitation which may possibly follow upon the heels of the trouble in the railway world.

Electrical railway issues are decidedly weak. The stocks of steam companies continue to be swayed by the strike developments from day to day, and the conference arranged between Mr. Lloyd-George and the railway directors formed an effective corrective to Mr. Richard Bell's Sunday lucubrations. But Central Londons go from bad to worse, and all three stocks are down this week. The flatness of the Ordinary has told upon the 4 per cent. Debenture stock, the price of which is down to 103½. City and South London Debenture stands at the same level, and the Ordinary stock of this company has lost its slight improvement, sliding back to 46. Great Northern and City Preferred shares have been done at 28s. 9d. this week.

It may be observed that because no dealings happen to be recorded in a stock, that does not necessarily imply the market is moribund. The marking of transactions is quite optional on the part of Stock Exchange members, so that it is possible—though improbable—that there may be a lot doing in some particular issue, without one of the prices of the bargains being recorded.

Metropolitan Consolidated fell back to 33½, a drop of 1½, but Districts kept steady at 11. The District Railway is having trouble, on account of so many of the ramshackle, matchbox carriages requiring replacement already, whereas the more solidly-built Metropolitan rolling-stock will last much longer. It is a fulfilment of the prophecy ventured upon here long ago, when the great difference in the construction work came under comment.

Mr. Marconi ought to be a proud man. His invention, as a commercial proposition, has knocked still more points off the stocks of the cable companies, and Eastern Telegraph Ordinary is £8 lower than it was a few days back. Eastern Extensions fell 10s., Western Telegraphs 5s., Cuba Telegraphs 10s., and Anglo-American stocks from one to two points. Against this, the shares in the Marconi Company are 2s. 6d. better at 22s. 6d. Moreover, Globe Telegraph and Trust shares of both kinds have declined 10s., and this, perhaps, is the most significant movement of all, because Globes are held by investors, for dividend—not speculative—purposes. It is, however, rather curious to notice even yet the scepticism of many members in the market, with regard to the payability of marconigrams under present conditions. The time test applied to the system by one of the newspapers last week turned out very badly for Marconi compared with cables, but impartiality must allow a certain margin for accidents at the outset of such a venture, even when the latter is made on a "commercial basis."

The flatness of Telegraph issues spread to the manufacturing division as well, and Telegraph Construction shares followed up a previous drop of £6 with a smaller fall of £2, while Henley's Ordinary shed 10s. Callenders kept firm.

Electricity Supply Ordinary shares remain steady, but several of the Preference show losses, ranging from ⅛ in the case of South Metropolitan, to ⅝ in that of St. James' and Pall Mall. Practical students of this department have at last unearthed a glimmer of hope for electrical prices in the prospects of extended use of the new metallic filament lamps of various kinds. Provided that the lamps can be made to accomplish all that is expected of them, and that still further improvements are introduced, it is contended that the cost of electricity must force itself upon public attention as being cheaper than gas.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Oct. 15th.	Closing Quotations Oct. 22nd.	Business done week ended Oct. 22nd, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	85 — 88	85 — 88	..	..	..	5 13 8
660,660	Anglo-American Telegraph	Stock	61s.	2⅜%	3½%	3⅜%	52 — 55 xd	52 — 55	52½	51	..	7 0 11
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5⅝%	6 %	6 %	93 — 96 xd	91 — 94	94½	91½	—2	6 7 8
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	⅛%	12½%	14½ — 14⅞	13½ — 14	14½	12⅝	— ⅜	12 10 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	8 %	6¾ — 7⅛	6¾ — 7⅛	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	91½	90	..	4 7 0
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	6¾ — 7¼	6 — 7	..	..	— ½	7 2 10
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3¼ — 3½	3¼ — 3½	..	..	..	5 14 3
5,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	9 — 9½	9 — 9½	..	..	..	5 5 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	8 18 2
60,710	Direct United States Cable	20	3 %	3½%	4½%	4⅝%	12 — 13 xd	12 — 13	12 9/16	12⅜	..	7 2 4
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	128 —133 xd	121 —126	128	120½	—7	5 11 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½ — 86½ xd	83½ — 86½	87½	83½	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 —104	101 —104	103	102½	..	3 16 11
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11¾ — 12½ xd	11 — 12	11½	11	— ½	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99 —102	99 —102	100½	100½	..	3 18 5
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	97½—100½	97½—100½	98½	98	..	3 19 7
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5⅝%	5½%	9⅞— 10⅛	9¼— 10⅛	10	9½	— ¼	5 7 4
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	12½ — 13⅛	12 — 13	12⅝	12	— ⅜	4 12 4
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	15 %	24 %	24%	20 %	34 — 36	34 — 36	..	..	..	5 11 1
28,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	54 — 56	54 — 56	..	..	..	5 16 1
$41,380,400	Mackay Companies Common	$100	..	1 %	2 %	3½%	64 — 67	50 — 60	..	..	—10½	5 16 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	64 — 67	50 — 60	..	..	—10½	6 13 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞— 1⅛	⅞— 1⅛	23/16	19/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	20/6	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1 — 1	1 — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —108	106 —108	107⅛	106½	..	5 11 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5 %	106 —108	106 —108	107½	106½	..	4 12 7
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 12½	10½ — 12½	..	..	..	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5¼ — 5½	5¼ — 5½	..	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96 — 98	97½	96	..	3 1 3
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	99½—101½	100½	..	— ½	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	6½%	7 %	7 %	15/16— 1	1 1/16— 1 1/16	..	..	..	5 4 8
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 11 5
100,000	Do. do. do. 4 % Red. Deb. Stock ..	100	..	..	4 %	4 %	91 — 94	91 — 94	..	..	..	4 5 1
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	124 —127 xd	124 —127	..	..	..	4 14 6
80,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	6¾ — 7⅛	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅛	10 — 10⅛	..	..	..	8 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 58,008	2	Nil	Nil	Nil	2½%	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 12 9
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	12½— 13½	12½— 13½	13	12½	— ¼	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —103	99½—101½	..	..	—1	3 18 10
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	7/16— 9/16	7/16— 9/16	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %†	6 %	5 %	8 %	7 — 8	7 — 8	7	..	..	10 0 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½— 7½	6½— 7½	..	..	..	Nil
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	101	100	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	8 %	7½— 8	7½— 8	7⅛	7½	..	5 0 0
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	5½%	6 1/16— 6 3/16	5 15/16— 6⅛	6 1/16	6	..	4 8 11
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	131 —134	131 —134	..	..	..	4 9 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
830,000	Babcock & Wilcox, 1 to 830,000	1	17 %	20 %	20 %	20 %	3⅜— 3⅝	3½— 3⅝	74/4½	71/10½	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	3 16 10
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	4 — 5	4 — 5	..	..	..	7 0 0
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	7 %	4⅞— 5⅛	4⅞— 5⅛	5⅛	5 1/16	..	6 10 3
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	6 %	4⅞— 5	4⅞— 5	..	..	..	6 0 0
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3¾— 4⅛	3¾— 4⅛	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	96 — 99	96 — 99	97	..	..	5 11 1
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	131 —136	130 —135	131	130½	..	4 8 3
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	112 —116	112 —116	115	113	..	4 6 2
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	104 —107	104 —107	104	..	..	4 13 6
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	98 —101 xd	98 —101	..	..	..	4 7 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —104	102 —104	..	..	..	4 6 7
133,301	British Electric Traction	10	6 %	6 %	3 %	Nil	1⅞— 2⅛	1⅞— 2⅛	41/8	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	5¾— 6	5¾— 6	5⅞	5⅝	..	10 0 0
1,448,655	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	78 — 81	78 — 81	..	..	..	5 11 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾— 7	6¾— 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞— 6⅛	5⅞— 6⅛	..	..	..	4 18 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	85 — 89	85 — 89	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
1,016,953	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	62 — 67	62 — 67	..	..	..	5 19 5
50,000 ‡	Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	7/16— 9/16	7/16— 9/16	..	..	..	Nil
50,000 ‡	Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	Nil	⅜— ½	⅜— ½	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	Nil	⅝— 1⅛	⅝— 1⅛	..	..	..	Nil
125,000£	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	83 — 86	83 — 86	..	..	..	5 4 8
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	67 — 70	67 — 70	..	..	..	6 8 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	3 %	4 1/16— 4 3/16	4 1/16— 4 3/16	90/-	..	..	2 4 0
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4½— 5⅛	4½— 5⅛	..	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4½— 5⅛	4½— 5⅛	..	..	..	5 14 3
13,200	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115	..	..	..	4 6 11
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
137,610	Calcutta Trams, 1 to 137,610	5	6 %	8 %	8 %	8 %	7 — 7⅛ xd	7 — 7⅛	7⅛	7 1/16	..	5 6 8
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 10 17
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	102 —106	100 —104	101	100	—2	4 6 7
35,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	15 %	9⅞— 10⅛	9⅞— 10⅛	..	..	..	7 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5⅜	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 8 4
491,222	Cape E Trams., 1 to 491,222	1	10 %	5 %	Nil	..	⅜— ½	⅜— ½	..	..	— 1/16	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1 1/16— 1 3/16	1 1/16— 1 3/16	24/-	..	..	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	98 —102	98 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	62 — 64	60 — 62	..	..	—2	6 9 1
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	88 — 90	87 — 89	..	..	—1	4 9 11
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	43 — 46	42 — 45	..	..	—1	8 17 10
1,480,000	City and South London Railway	Stock	2⅜%	2⅜%	1⅞%	2⅜%	46 — 48	45 — 47	47	45½	..	4 8 7

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 15th.	Closing Quotations Oct. 22nd.	Business done week ended Oct. 22nd, 1907.		Rise + or Fall —	Present Yield per cent.
		*	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s.
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	2½%	2½%	5 %	1⅞ — 2	1⅞ — 2	..	..	..	7 5 5
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	10 %	1¼ — 1½	1¼ — 1½	..	..	..	6 13 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6%	6 %	13 — 14	13 — 14	..	..	..	4 5 9
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅝— 13⅝	12⅝— 13⅝	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	Nil	2½%	4½%	4½%	1⅛— 1⅝	1 — 1⅛	22/6	..	— 1/16	9 11 1
17,139	Do. "A" shares, 01—017,139	5	Nil	2½%	4½%	4½%	2½ — 2¾	2½ — 2¾	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	87 — 90 xd	87 — 90	..	..	..	5 11 1
112,100	Electric Contruction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	Nil	½ — 1	½ — 1	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	90 — 93	90 — 93	..	..	..	4 6 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	3 %	4 %	4 %	4 %	1½ — 1⅝	1½ — 1⅝	28/9	..	..	20 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10⅜ — 10¾	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11 — 12	10½— 11½	10½	..	— ½	6 10 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5⅝	..	..	..	8 17 8
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106½—107⅛	106½—107⅛	106½	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	5 %	10%	10 %	144 — 154	144 — 154	15	14½	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	1¾%	1¼%	Nil	Nil	1⅜ — 1⅞	1⅜ — 1⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	7⅛ — 8	7⅛ — 8	..	..	..	5 14 11
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	6 %	8 %	8 %	6¾ — 7⅛	6¾ — 7⅛	..	..	..	4 0 0
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	8 %	8 %	6¾ — 7⅛	6¾ — 7⅛	..	..	..	4 0 0
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	8 3/32	7 15/16	..	5 14 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 — 5/32	3/32 — 5/32	17/6	..	..	5 2 7
350,000	Do. do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 10 11
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	¼ — 3/16	5/16 — 3/8	..	..	+ 1/16	7 2 3
246,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¼ — ⅜	¼ — ⅜	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	80 — 82	80 — 82	..	..	..	5 18 2
150,000	Do. 4 % Ded. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—102½	99½—102½	..	..	..	3 18 1
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	48 — 53	46 — 51	..	..	— 2	9 16 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1¼ — 1⅜ xd	1¼ — 1⅜	5/-	..	..	Nil
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¼ — 4¼ xd	3¼ — 4¼	2 6/3	75/-	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	74 — 78	75 — 80	7..	..	+1½	5 0 0

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P,. 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜— 5⅛ xd	4⅜— 5⅛	97/6	96/3	..	5 7 4
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7⅞ — 8	7⅞ — 8	..	..	..	6 13 4
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 4 10
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	98 —101	..	..	— 1	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅝— 4⅛	3⅝— 4⅛	81/3	78/9	..	6 1 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	81/3	..	..	5 12 6
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 3¾	3⅝ — 3¾	67/6	..	..	5 16 2
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¾ — 4⅛	3¾ — 4⅛	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of Londo Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	8⅜ — 9⅜	8⅜ — 9⅜	9	..	..	6 3 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	..	..	..	5 4 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	3⅜— 4⅜	3¼— 4¼	72/6	..	— ⅜	4 14 1
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4⅜— 4¾ xd	4⅜— 4¾	..	..	..	5 2 7
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	6½ — 7¼	6⅞ — 7⅞	7 3/4	..	..	6 9 0
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 — 11	10 — 11	10⅞	10⅜	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	109 20/32	107⅛	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	Nil	½ — 1	½ — 1	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	3 %	1 — 1⅛	1 — 1⅛	..	..	..	8 11 5
350,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	76 — 81	76 — 81	..	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 18 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	6½— 7 xd	6½— 7	..	..	..	6 8 7
21,000	Kensington and Knightsbridge Electric Ord.	5	12½	12 %	10 %	10 %	8¼ — 9¼	8¼ — 9¼	..	..	..	5 8 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1½ — 1⅝	1½ — 1⅝	..	..	..	6 16 2
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4¼ — 4⅜	4¼ — 4⅜	..	..	— ⅛	6 9 9
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	89 — 93	89 — 93	92	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8¾%	10 %	10 %	8 %	5⅛ — 5⅜	5⅛ — 5⅜	5 5/16	5¼	..	6 19 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 7 10
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 10 0
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	87 — 92	87 — 92	..	..	..	3 16 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	5 18 6
75,000	Do. 5 % Pref., 1 to 75,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	11 — 12	11 — 12	..	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	5¾ — 6	5¾ — 6	5 13/16	..	..	5 16 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6 — 7	6 7/8	..	— ⅛	5 0 0
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3 %	3½%	86 — 91	86 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	¾ — 1¼	..	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75	71 — 75	..	..	..	6 0 0
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	6 6 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	⅜ — ⅝	⅜ — ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	15/16 — 1 1/16	20/-	..	..	5 17 11
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	— 1/16	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	11 10 6
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝ — 2⅜	1⅝ — 2⅜	..	..	..	8 13 11
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	..	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
110,000	Westminster Electric Supply, Ord.	5	13½%	14 %	13 %	12 %	8½ — 9½	8½ — 9½	..	..	..	6 9 9
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	5 %	4½%	4⅝ — 5⅛	4⅝ — 5⅛	97/6	..	— ⅛	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent., August 15th, 1907.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1907.

The returns of electrical business for September, leave little to be desired, even though they do not quite reach the standard of the preceding month.

Thus the exports of electrical goods from the United Kingdom attained the respectable total of £181,390, a figure only some £8,400 below the preceding month's high value, and nearly £50,000 in excess of the 1906 monthly average.

The Import section does not show so much activity, the September total of £146,450 being over £9,000 less than the August total and slightly under the average for the 12 months of 1906.

The re-export of foreign and colonial electrical goods from this country has shown a rising tendency in recent months, and this month's value, £26,393, is the highest so far recorded by us.

As showing the improved trade of the past nine months, particularly as regard the Export section, the average monthly value of the latter during the period in question was over £161,000, which compares with £127,000, the corresponding figure for the previous year. With the Import section, the figures for the two periods are (1906) £145,000 and (1907) £154,000, showing the relatively greater improvement in the Export section.

The month's electrical machinery and cable exports at £78,000 and £57,000 approx. respectively are almost identical with the August figures; some decrease is shown in the corresponding imports. Over £30,000 worth of telephonic and telegraph material figures in the Import section and a noteworthy item of £17,000 worth in the Re-export section.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.*

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material, and electric bells.	Electrically-driven machinery	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	939	903	199	21	...	12,022	194	2	...	13	1,023
Germany	369	5,656	47	3	12	634	5	...	...	25	...
Netherlands and Java	91	978	688	28	...	303	...	3	12	...	...
Belgium	202	58	236	115	13	463	...	26	907	...	...
France and French Indo-China	270	14	54	10	60	1,438	476	4	25	...	...
Portugal, Madeira and Portuguese Africa ...	487	930	12	45	6	507	7	...	87	...	...
Spain and Canary Isles	55	8	...	8	14	53	...	...	26	200	...
Italy and Austria-Hungary	...	25	23	704	...	357	...	...	100	...	...
Greece and Roumania	35	...	32	78	...	19	...	...	...	...	...
Egypt	208	260	160	153	6	85	36	...	10	14	...
China and Siam	1,430	799	304	25	13	4,249	...	...	8	214	...
Japan	585	13,695	1,059	160	587	12,112	93	...	...	90	...
U.S.A.	74	...	14	53	14	705	23	180	...	...	...
Mexico, Nicaragua and Costa Rica	26	2,601	...	55	...	1,253	2	...	9	...	...
Colombia, Venezuela, Ecuador, Peru and Uruguay	212	29	258	26	22	4	4	...	...	...	18
Chile	90	912	346	29	...	2,600	220	...	55	1,397	...
Brazil	301	863	287	198	437	1,773	...	19	...	205	...
Argentine	3,293	3,027	476	116	609	4,130	166	62	...	945	...
Channel Isles, Gibraltar and Malta	138	353	182	...	407	102	...	26	...	....	...
British West Africa	9	19	264	25	...	297	...	2	21	...	...
Cape of Good Hope	385	2,103	292	150	43	1,578	57	70	621	...	...
Natal	792	544	737	519	705	1,164	143	4	82	....	...
Zanzibar, Brit. East Africa, Mauritius & Aden...	2	...	92	...	...	1,902	43	...	59	23	...
India...	2,152	8,954	1,438	454	911	14,133	217	2	141	800	618
Burmah	313	254	255	134	116	546	...	64	...	17	...
Ceylon	68	42	30	54	61	51	49	...	116	53	...
Straits Settlements and Fed. Malay States ...	93	632	379	170	71	150	83	...	53	105	...
Hong Kong	55	212	366	26	6	2,623	15	...	13	430	277
West Australia	213	594	41	2	5	137	1,475	18	...	...	...
South Australia	568	90	163	142	...	1,063	20	...	...	...	...
Victoria	767	7,999	351	27	427	1,929	26	20	90	...	...
New South Wales	1,490	580	223	791	...	3,310	52	...	34	363	...
Queensland	61	...	106	...	...	...	...	...	542	...	...
Tasmania	240	...	...	...	...	71	...	...	...	...	...
New Zealand and Fiji	740	4,332	916	513	50	823	63	...	185	49	...
Canada and Newfoundland	43	840	238	86	49	65	5	...	...	480	...
British West Indies, British Guiana and Falkland Islands	41	...	...	18	...	8	44	9	181	...	...
Total, £	16,797	57.306	10,268	4,938	4,644	72,659	3,518	511	3,377	5,423	1,936

Additional exports: Danish West Indies, goods, £13.

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Russia, Norway, Sweden and Denmark	62	465	136	..	...	1,672	936	...	13,930	...	...
Germany	165	9,127	1,713	3,142	146	32,624	1,004	1,211	1,667	...	...
Holland	103	6,986	410	7,019	209	1,857	652	3,595	368	530	...
Belgium	283	2,839	332	2,771	189	4,840	114	1,128	10,265	...	...
France	9	5,465	2,314	782	926	776	364	2,681	3,990	...	...
United States	4,454	139	873	514	...	9,087	132	256	327	598	...
Italy and Austria-Hungary	...	74	...	...	...	37	...	...	...	...	..
Total, £	5,076	25,095	5,778	14,228	1,470	50,893	3,202	8,871	30,547	1,128	...

Additional imports: Channel Islands, machinery, £150; Victoria, machinery, £12.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	1,937	2,740	604	1,398	...	2,166	80	317	17,142	9	...

Total Exports: £181,390

Total Re-Exports: £26,393

Total Imports: £146,450

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

* This section does not include telegraph cables and apparatus.

OLYMPIA EXHIBITION.

Saturday last witnessed the closing of this exhibition, with its fine display of tools and general engineering appliances. As not the least important items of the machine tool exhibits were electrically operated, some further reference to this section of the exhibition is justified.

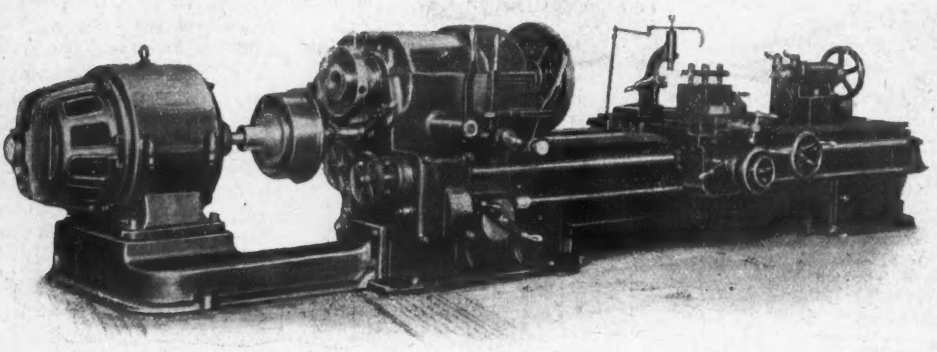


Fig. 1.—Electrically-Driven Heavy Duty Lathe, by J. Stirk & Sons.

It will be recollected that Messrs. John Stirk & Sons, of Halifax, were prominent exhibitors of self-contained motor-driven tools at last year's Olympia exhibition; this year they were represented by several lathes, a radial drilling machine, and 30-in. boring and turning mill. Their most interesting lathe exhibit was shown in operation on Messrs. Sanderson Bros. & Newbould's stand, and consisted of a 12-in. high-speed lathe, direct driven by a 35-h.p. variable speed motor. This tool is designed for heavy duty, and is fitted with an all-gear head, containing 18 gears, which give 16 changes of speed for the spindle, ranging in geometrical progression from 200 to 10 r.p.m. This lathe is very substantially constructed, and when running with a $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. by 1 in. SaBeN tool, will remove 10 cwt. of turnings from mild steel bar. Fig. 1 illustrates the lathe and motor, the latter by the Lancashire Dynamo and Motor Co.

Messrs. Craig & Donald, Ltd., of Johnstone, near Glasgow, exhibited their improved patent plate-flattening rolls, direct coupled to a 12-b.h.p. motor (by J. P. Hall & Co.), shown in fig. 2. The machine is of the four-roller type; the large top (bending) roll has an independent adjustment for each end, so that if a plate has one side longer than the opposite side, the shorter side can be drawn out by pressing the roller harder on that side, this materially aiding in removing the buckle out of thin plates. The driving motor is of the series wound reversing type and fitted with a magnetic brake. The machine is specially adapted for ship-yard and bridge work.

Messrs. John Lang & Sons, who also hail from Johnstone, were showing several of their well-known lathes, fitted with Lang's patent variable speed drive. Our illustration (fig. 3) shows the fast head stock and motor drive of their 10-in. sliding, surfacing and screw-cutting lathe. The motor is run at constant speed, and all speed variations of the spindle are obtained through the variable speed drive. The latter consists essentially of two coned pullies with movable flanges, coupled together by a belt drive, utilising a belt of special pattern. By means of a hand wheel (seen to the right of the motor starter, fig. 3) the flanges of one cone wheel are drawn nearer together and those of the other separated, simultaneously, this, of course, increasing the (driving) diameter of one coned wheel and correspondingly decreasing the (driven) diameter of the other, and increasing the speed of the lathe spindle. Obviously, the reverse movement can be made, and the spindle speed can be accurately and easily adjusted to obtain exactly the required cutting speed. The arrangement is exceedingly simple, and largely employed in Messrs. Lang's own works and by other firms. The lathe in question was also fitted with the firm's latest type of bed, which introduces many improvements in the working of the saddle.

Turning for a moment from metal working machinery, an ingenious electrically-operated wood-working tool was shown by Messrs. Wadkin & Co., of Leicester, which is illustrated in fig. 4. This machine embodies special features which enable it to deal with every kind of pattern work, and, indeed, almost any operation in wood working. The machine has practically universal motions to the cutter-head and the table, and both are provided with quick and fine positive

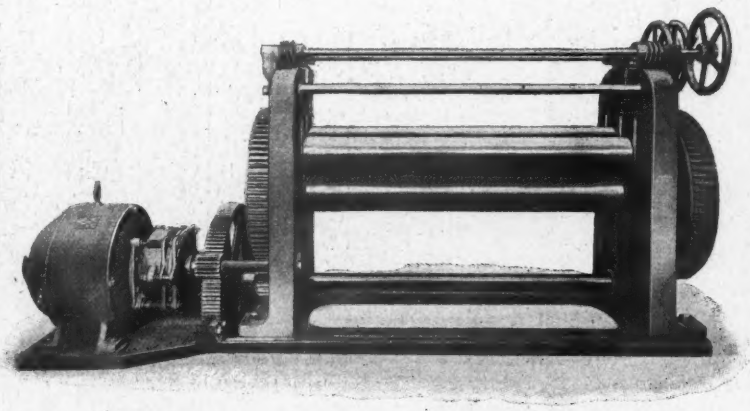


Fig. 2.—Motor-Driven Plate Flattening Rolls, by Craig & Donald, Ltd.

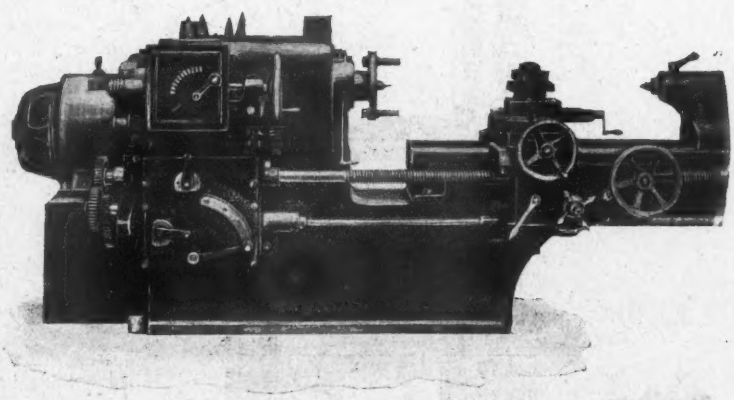


Fig. 3.—Compact Motor-Driven Headstock, Lang's 10-in. Lathe.

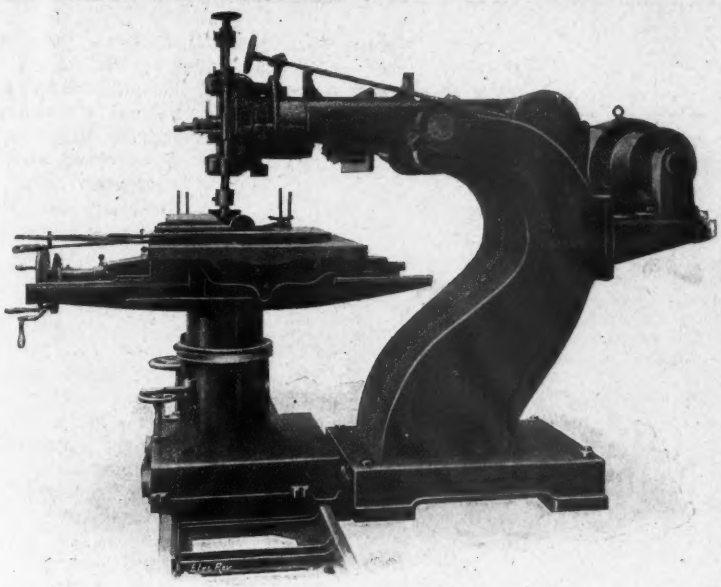


Fig. 4.—Wadkin's Patent Mechanical Wood-Worker with Motor Drive.

feed motions. The cutting head of the machine is situated at one end of a balanced rocking arm, and can be swung down to the table level, and swivelled so that the spindle lies horizontally or at any angle required; the table can also be moved in any direction. The motor, as will be seen from our view, is fixed to a bracket behind the machine, and the starting and speed regulating switchgear is fitted on one side of the arm carrying the cutting head.

Messrs. Pollock & Macnab, Ltd., of Bredbury, near Manchester, had a variety of "Apollo" lathes and other machinery on view. We illustrate in fig. 5 a 23-in. combination turret lathe for rapid turning and chuck work, direct-coupled to a constant speed motor supplied by the Lancashire D. and M. Co. This machine is fitted with an "all gear" head giving 16 direct spindle speeds; a feature of the "all gear" drive is that, unlike the ordinary speed cone drive, it gives a constant cutting power and output on all diameters. The feed box is self-contained, and can be removed for inspection without disturbing the lathe; the whole of the wheels are of steel, and give eight rates of feed in forward and reverse directions, also four different threads for screw cutting, without altering the wheels. The lathe is fitted with a hexagon turret, rotated by hand; it can be used for a great variety of chuck work, in addition to turning from the bar.

This firm also exhibited an "Apollo" radial drilling, tapping and studding machine, which was operated by a

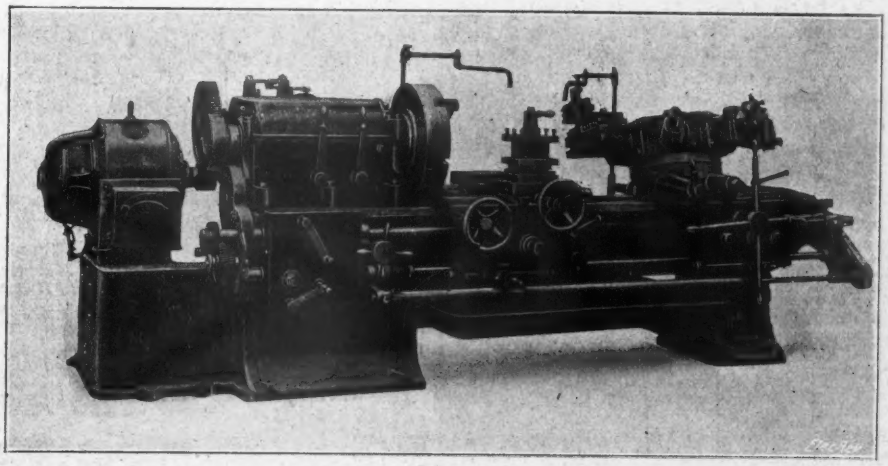


Fig. 5.—Electrically-Driven "Apollo" Turret Lathe, by Pollock & Macnab, Ltd.

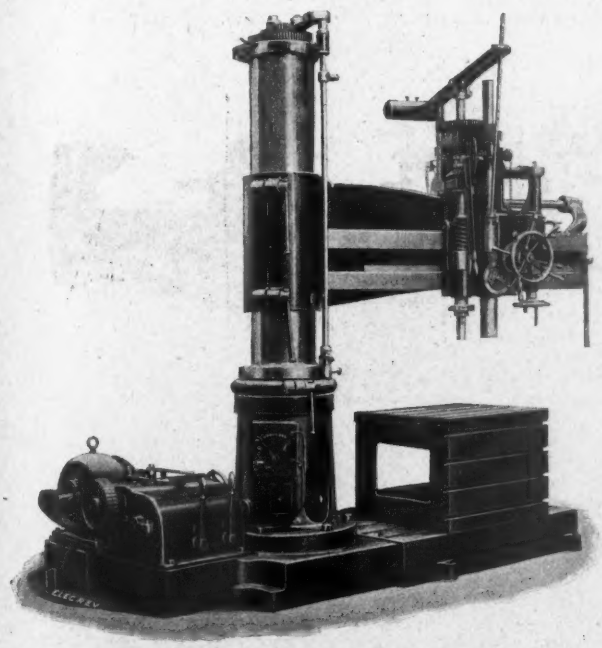


Fig. 6.—"Apollo" Radial Drill, with Chain Drive from Motor.

4-h.p. electric motor, driving by means of a Hans Renold chain direct on to the gear box. This machine is illustrated in fig. 6, which gives a good idea of its arrangement. The gear box gives sixteen speeds in geometrical progression, which amply cover the range required for high-speed drilling; the gears run in an oil bath. The spindle has a quick advance and return, and a dial motion—indexed to set the depth required to be drilled. The machine has a separate tapping spindle with reversing motion by power; an ordinary box table is shown, but for angle drilling a table, which swivels 90° in a vertical plane, is supplied.

Messrs. Kendall & Gent, Ltd., Manchester, had on view several compact electrically-operated tools, of which fig. 7 illustrates a 2-in. spindle Plano profile milling machine. It will be noted that the uprights carry brackets, on which a motor is fitted when an electrical drive is required. The spindle of the machine is arranged for driving either single speed or double gear; and the feeds to the table and spindle slide can be operated either by hand or power.

Several of the machines on this stand, including the above, were shown in operation driven by motors of the Lancashire D. and M. Co.'s make.

The Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, had on view several examples of their handy electrical drilling and grinding machines, which have been previously described in our pages, and the United States Metallic Packing Co., Ltd., also of Bradford, were show-

ing in addition to their well-known metallic packing and other items, electrical and compressed air-driven drills.

The Light Electric Motor Co., Ltd., were showing some

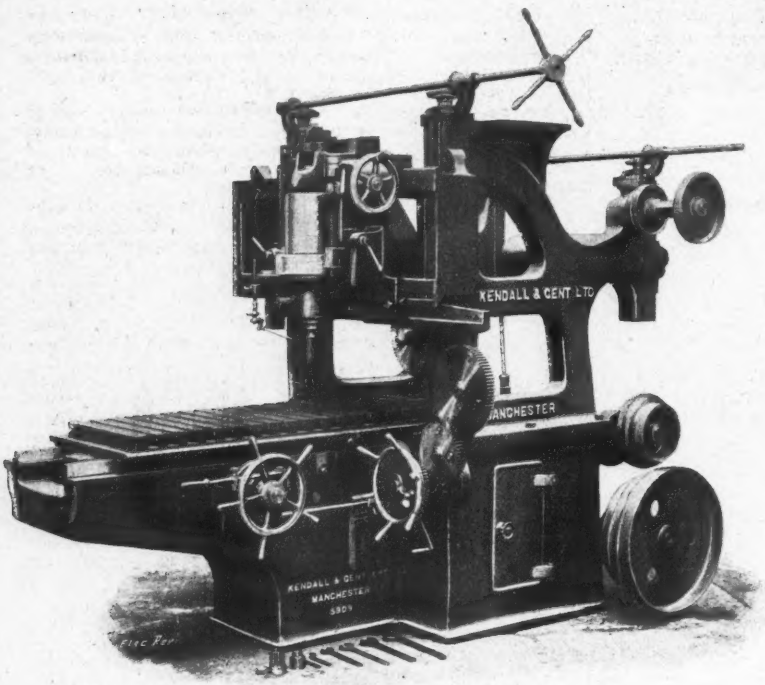


Fig. 7.—Plano Milling Machine, with Bracket for Electric Motor; Kendall & Gent, Ltd.

handy little portable electric drilling machines, of the type illustrated in fig. 8. These drills can be operated from existing lighting circuits, either alternating or direct current, and are fitted with hand-screw feeds for use when it is not possible to use the breast plate; the larger sizes weighing some 40 lb. will drill up to $1\frac{1}{4}$ in. holes, and smaller ones weighing 9-10 lb., up to $\frac{5}{16}$ in. diameter holes.

We may conclude our notice by a reference to Messrs. Reavell & Co.'s exhibit, which, of course, specialised in air compressors. The exhibit included two and three-stage jacketed quadruplex machines suited for various pressures. One of these, a two-stage compressor, with a free air capacity of 230 cb. ft. per min, was direct coupled to a 45 B.H.P. by the General Electric Co., Ltd. This plant is an exceedingly compact one, having only two bearings carrying the whole of the rotating parts; it is designed for operating pneumatic tools, coal-cutters, &c. In addition to compressors, an air hoist capable of lifting 3,500 lb. with air at 80 lb. pressure, was on view. The Reavell compressor has frequently been described and illustrated in our pages.

THE BRITISH MANUFACTURER'S FEAR OF PUBLICITY.

By W. O. HORSNAILL.

No one will deny that additional business is obtained by keeping a firm's name and doings constantly before possible purchasers, and apart from the ordinary advertisement, this purpose may be carried out by several less costly methods. For instance, a wide circle of prospective customers may be inspired with confidence in the products of a manufacturing concern by a well-written and illustrated description of the works and manufacturing processes, in one of the leading technical journals. Buyers of machinery are favourably impressed by the knowledge that their purchases are turned out in a well-equipped and carefully managed works, as the products from such a factory are obviously more likely to be well made than if manufactured in old-fashioned, badly arranged shops. This fact is fully appreciated by a few go-ahead undertakings who are always anxious to show their plants to anyone desirous of inspecting them, particulars and photographs being willingly placed at the disposal of the technical Press.

This attitude, unfortunately, pertains to only a limited number of manufacturers, the majority preferring to preserve more or less secrecy regarding their methods of production.

In bygone days it was quite possible for the pioneers in any industry to keep their special knowledge mostly to themselves. Their workmen began as boys, or apprentices, and remained with the firm until old age prevented further service, the foremen and staff being of nearly as permanent a character. Moreover, skill in any particular industry was then almost entirely a matter of experience, few text-books or technical journals were available, and such knowledge as existed was largely vested in individuals.

All these conditions are now changed; the apprentice, as soon as he has completed his training, moves to other factories for the purpose of increasing his experience, the younger workmen are always willing to make a change for the sake of a small increase in wages, and the foremen and technical staff are frequently moving from one works to another where there is a better chance of improving their positions. Then, again, any intelligent person, having had a practical training in a certain industry, can glean almost all there is to know from the technical Press. It must be admitted that new processes and appliances are being con-

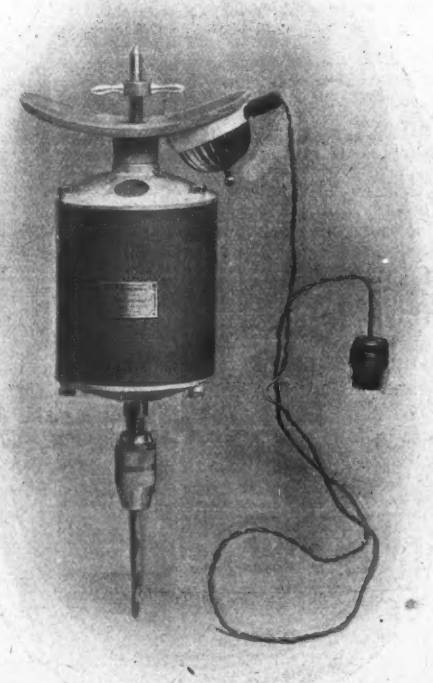


Fig. 8.—Eight Electric Motor Co.'s Drill, Olympia.

tinually brought out, but it is impossible to keep the knowledge of them away from trade rivals if such inventions are to be carried into extended use.

Under such conditions as these, it is impracticable for a manufacturer to keep his methods secret; rival concerns

can, and do, know exactly what he is doing. This knowledge is obtained in various ways; prices are sought for through third parties, workmen may be attracted by the offer of higher remuneration, and it is quite easy to obtain information by other means, which, although of a somewhat unscrupulous nature, may at any time be employed by a keen rival. The only effect, therefore, of these attempts at secrecy is to attract inquiry, whilst the unrivalled advertisement to be effected by making the firm's methods and business public is entirely lost.

One curious feature in connection with this fear of publicity is the care with which many firms whose methods and designs are hopelessly out of date, guard their supposed secrets; this attitude being preserved under the mistaken impression that a knowledge of their processes is of value to their competitors.

The correct course in these days is to run an experimental department, where all new designs and improvements are worked out, the Patent Office being freely made use of for their protection where possible. The doings of such a department would naturally be kept secret until the new apparatus or processes were perfected, when the fullest possible publicity should be given.

The fear of publicity is a relic of the past when more was to be gained by concealing new designs and processes from trade rivals than any benefit which would have followed such publication as was then available. Altered conditions have entirely reversed this position; it is now impossible to conceal effectively any process, or design, when put into practice, and the value of publication as an advertisement has enormously increased.

The electrical manufacturing industry has been in a bad way for some time, and every possible means of making their products known and appreciated should be employed by electrical engineering undertakings. Their names should be constantly before the public in one form or another. One very effective method of carrying out this purpose is by means of small paragraphs in the technical Press calling attention to the receipt of all large orders. The writer has in mind one of the largest electrical undertakings in this country, who have always made the best use of this plan, which has resulted in a very rapid increase of business.

Illustrated descriptions of factories should be widely published. It may be contended that many undertakings are made up of old-fashioned shops, which do not figure well in illustrations, the answer to this contention is that works of this nature require rearrangement. If the appearance of the shops will not bear public inspection, the owners may be quite certain that the equipment is radically wrong, and requires remodelling. No dirty, badly arranged works can hope to make profits in these days of keen competition.

Then, again, when buildings are extended it is of especial importance that notice of these developments be published; the effect upon possible purchasers of knowing that certain works are being enlarged, must obviously be to inspire confidence. The argument used against this publicity by many firms is that they do not wish their competitors to know what they are doing, an attitude which can only be likened to an ostrich who hides his head in the sand under the mistaken impression that he is entirely concealed. All up-to-date concerns make it their business to be fully posted in any developments which may be going on in competitive undertakings, and, as we have already shown, no serious difficulty is likely to be met with in gaining such knowledge.

As the struggle for existence becomes keener, all manufacturing engineers will have to fall in line with the few go-ahead firms who have already taken advantage of the publicity methods indicated above.

New Cable to Cuba.—The Commercial Cable Co.'s new cable between New York and Havana was opened for public service on the 21st inst. This cable provides the most direct and speedy route between Great Britain and Cuba, there being only two intermediate points of transmission, viz., at Waterville, Ireland, and New York. The rate per word from Great Britain to Havana is 1s. 8d. The cable was manufactured by the India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd., of London, and has been laid by that company's cable-steamer *Silvertown*.

POSSIBILITIES OF LARGE GAS ENGINES IN ENGLAND.

We have received from Mr. Leonard Andrews, managing director of the Key Engineering Co., Ltd., the results of an interesting investigation into the scope for the use of large gas engines for generating electric power in this country, from which we abstract the following particulars and estimates:—

Taking first the utilisation of blast-furnace gases, on the basis of the production of pig-iron in Great Britain for 1906—namely, 10,149,388 tons, the waste gases evolved would be capable of generating over 2,000,000 B.H.P. continuously. Of this about 50 per cent. would be required for blowing, heating the air blast, &c., leaving one million H.P. available for other purposes. In works where finished steel was turned out, the whole of this power could be utilised for driving rolling mills and other machinery, dispensing almost entirely with the use of coal, as, for instance, at the Differdinger Iron and Steel Works mentioned in our last issue. In Germany this economy has been largely realized, while here but little has been done in this direction. Where the power was not used on the works, it could be sold to outside users at a very low rate with profit.

The use of special producers to generate the gas stands upon a different basis. In order to illustrate the possibilities in this case, Mr. Andrews works out a concrete example, comparing the cost of a 16,000-KW. steam turbine plant with that of the corresponding gas installation, spare plant being included in each case. The figures are as follows:—

Capital Outlay.

	Steam turbine.	Gas engine.
Engine and generators	£96,000	£161,700
Boilers, boiler house, feed pumps, coal-handling plant, and pipe work... ...	81,000	—
Producers, gas-cleaning and coal-handling plant with pipe work	—	77,700
Engine-room building, cranes and engine foundations	18,000	42,000
Switchgear and wiring for ditto.	5,250	5,250
	£200,250	£286,650
Allowance for contingencies, 5 per cent. ...	10,012	14,332
	£210,262	£300,982
Capital cost per KW. installed	£13·1	£18·88

Running Cost on 100 per cent. Load Factor.

KW.-hours per annum, 140,000,000.		
Fuel, 165,000 tons at 10s.	£82,500	—
Fuel, acid, stores and repairs for producers, less by sale of by-products	—	£28,250
Labour	7,000	9,000
Repairs of turbine plant, including boilers	8,750	—
Repairs of gas engine plant, exclusive of producer plant	—	6,400
Oil, waste and stores (exclusive of producer stores)	1,750	4,370
Interest and depreciation at 10 per cent. ...	21,026	30,098
Total cost	£121,026	£78,118
Total cost per KW.-hour	·204d.	·135d.

The above figures, which are based upon data from a number of actual installations, show that for a 16,000-KW. plant running on a 100 per cent. load factor, the cost of generating by modern steam turbines is more than 50 per cent. greater than for modern gas engines run on by-product recovery plant.

Unfortunately, a 100 per cent. load factor does not fall to the lot of a public supply undertaking, and many engineers have to consider the problem of supplying power at as low a load factor as 15 per cent. Under the latter conditions the costs are:—

	Steam turbine.	Gas engine.
KW.-hours per annum, 21,000,000		
Fuel	£16,500	£8,750
Labour	4,800	6,000
Repairs	4,700	3,600
Oil, waste and stores	580	1,200
Interest and depreciation, 10 per cent.	21,047	30,098
	£47,627	£49,648
Total cost per KW.-hour ...	·545d.	·566d.

It would appear from the above, therefore, that for so low a load factor as 15 per cent. nothing is to be gained by putting down a gas engine installation instead of a steam turbine plant. But with a low load factor it may pay to sacrifice economy of fuel to low capital charges, whereas with a high load factor economy of fuel is of the utmost importance.

If a composite load curve giving the average daily load of a power supply station throughout the year is examined, it will be found in most cases that it is possible to run 25 per cent. of the total plant required for maximum load at an average load factor of from 60 to 80 per cent., and it will also be found that this portion of the plant will generate from 60 to 75 per cent. of the total units generated.

It would appear, therefore, that the most economical arrange-

ment of plant would be to put down gas engines with by-product recovery plant for 25 per cent. of the output to be dealt with, and to put down steam turbines with their comparatively low capital cost to deal with the remainder of the load. Detailed costs of such a plant have been received, unfortunately too late for inclusion here.

Mr. Andrews concludes that the practice sometimes advocated of installing gas engines for the peak load, thereby taking advantage of their extremely low stand-by losses, and installing steam plant for the high load factor portion of the demand, is obviously altogether wrong.

ELECTRIC RAILWAY STATISTICS.

In an Appendix to the annual Railway Returns issued by the Government printers, it is stated that at the end of 1906 the length of line in the United Kingdom (in equivalent of single track) worked solely by electricity, was 197¼ miles, and that 157½ miles were being worked partly by electricity. The corresponding lengths of line at the end of 1905 were 140¼ and 170½ miles respectively. The total quantity of electrical energy used in 1906 was 159,581,401 Board of Trade units, as compared with 100,977,467 in 1905. It will be observed that the line marked †, though generally described as a tramway system, is here included as an electric railway, presumably owing to its running for part of the way along an enclosed private track.

Electric Railway Statistics, 1906.

Name of railway.	Length of line over which electric trains were run during the year.		Number of miles travelled.						Number of electric locomotives.	Number of electric motor-cars carrying passengers (excluding motor-cars running on ordinary roads).	Number of cars other than motor-cars carrying passengers.
			By passenger trains or cars.		By goods and mineral trains or cars.		Total.				
	Lines *solely* worked by electric traction at the end of the year. Total miles.	Lines *partly* worked by electric traction at the end of the year. Total miles.	By electric trains (train-miles).	By electric cars (equiv. No. of car-miles).	By electric trains (train-miles).	By electric cars (equiv. No. of car-miles).	By electric trains (train-miles).	By electric cars (equiv. No. of car-miles).			
Baker Street and Waterloo (*f*)...	7½	—	598,668	1,586,582	—	—	598,668	1,586,582	—	36	72
†Blackpool & Fleetwood Tramroad	15	—	625,110	625,110	—	—	625,110	625,110	—	31	3
Central London	12	—	1,279,698	8 526,002	—	—	1,279,698	8 526,002	2	64	172
City and South London	12	—	1,105,606	5,121,180	—	—	1,105,606	5,121,180	52	—	140
Great Northern and City... ...	7	—	616,506	2,140,321	—	—	616,506	2,140,321	—	31	45
G.N., Piccadilly & Brompton (*g*)	18	—	72,585	219,485	—	—	72,585	219,485	—	44	92
Lancashire and Yorkshire ...	1	62	1,387,000	4,592,000	—	—	1.387,000	4,592 0 0	—	52	52
Liverpool Overhead	14	—	818,109	2,045,272	—	—	818,109	2 045 272	—	44	7
London, Tilbury and Southend ...	6	—	266,671	1 418,405	—	—	266 671	1 418,405	(*a*)	(*a*)	(*a*)
Mersey	9	—	829,188	2,376,730	—	—	829.188	2 376,730	—	24	33
Metropolitan	33	16½	1,555 222	8,959,129	—	—	1,555 222	8,959,129	10	99	206
Metropolitan District	48	—	2,368,928	10,833,378	—	—	2,36 ,928	10,833,378	10	198	235
Metropolitan District (working over the L. & S.W. Railway) ..	—	16	313,325	1,549,405	—	—	313,325	1,549,405			
Metropolitan and Met. District City Lines and Extensions ...	3½	—	252,011	1,386,346	—	—	252,011	1,336,346	(*b*)	(*b*)	(*b*)
North-Eastern	1¼	63	1,199 729	3,772,601	5,516	74,986	1,205,245	3,847,587	—	60	44
Waterloo and City	3	—	185,619	481,539	—	—	185,619	481,539	—	17	12
Whitechapel and Bow	4	—	179,796	947,575	—	—	179 796	947,575	(*a*)	(*a*)	(*a*)
Bessbrook and Newry	3	—	—	—	—	—	23,376(*d*)	41,376(*k*)	—	2	1
Total—1906	197¼	157½	13,653,771	56,581,060	5,516	74,986	13,682,663(*e*)	56,697,422	74	702	1,114
Total—1905	140¼	170½	9,640,921	(*c*)	2,870	17,847	9,667,429(*h*)	(*c*)	92(*i*)	550	838

(*a*) Supplied by Metropolitan District Co. (*b*) Supplied by Metropolitan and Metropolitan District Companies. (*c*) Cannot be given. (*d*) Mixed trains. (*e*) Including 23,376 miles run by mixed trains. (*f*) Line opened for public traffic on March 10th, 1906. (*g*) Line opened for public traffic on December 15th, 1906. (*h*) Including 23,638 miles run by mixed trains. (*i*) Including 26 locomotives withdrawn from service. (*k*) Partly estimated.

ELECTRIC LAMP DEVELOPMENTS.

On September 14th last the *Electrical Review* of New York issued a special Illumination Number containing a number of interesting articles on photometry, high efficiency lamps, and so forth. From these we have culled the following :—

Dr. Edward P. Hyde writes on photometry as practised at the Bureau of Standards. The Bureau was established in 1901. The work in photometry was not, however, commenced till the end of 1902. The photometric staff at first consisted of one assistant, but now numbers five persons.

The principal items of equipment are the following :—One standard photometer of the Reichsanstalt pattern, fitted with Lummer-Brodhun contrast screen. Sector disks are employed for reducing the power of the lights when great. A very ingenious lamp spinner is employed for measuring the distribution of the light from incandescent lamps. The lamp is spun on its axis, which is arranged to be horizontal instead of vertical as is the more usual. This arrangement allows of mercury cups being used for conducting the current to the lamp, and for making the potential contacts. At the same time the lamp can be swung round, so that not only mean horizontal candle-power can be measured, but also the mean conical candle-power at any angle above or below the horizontal. The usual potentiometer equipment is included. A noteworthy feature is that the standard photometer is placed in a room with light-coloured walls, stray light being intercepted from the Lummer screen by means of a number of black velvet screens.

Mean spherical and mean hemi-spherical candle-power is directly measured with a Matthews integrating photometer. This stands over 10 ft. high, and is fitted with 20 pairs of mirrors, which have had to be specially adjusted to compensate for the failure of the Lummer screen to follow Talbot's law. Compared with the Russell-Leonard integrating photometer, which needs no adjustment, and need not be more than 18 to 24 in. in diameter, according to the number of mirrors fitted, this appears somewhat unwieldy and costly.

A commercial photometer bench is also included in the equipment. This is used mainly for testing lamps for the various Government Departments. A spectrophotometer also forms part of the equipment.

The Bureau possesses five Hefner standards, two Harcourt standards and one Carcel standard, but for the present the actual standard of reference in daily use is the mean of a number of incandescent lamps.

Mr. Francis W. Willcox contributes an article entitled "The Recent Incandescent Lamp Developments and their Significance." Mr. Willcox is connected with the Lamp Department of the General Electric Co., and therefore knows all about the Gem metallised filament lamp. Unflashed filaments are first metallised by treatment in an electric furnace, the filaments are then flashed and afterwards treated to the metallising furnace treatment again. The double process appears to be absolutely necessary, and the result is a filament consuming 2·5 watts per candle-power having the same life as an ordinary filament consuming 3·1 watts per candle-power. This is for 110-volt lamps. For high-voltage lamps having much finer filaments, the process shows little or no improvement. The improved results obtained by metallising are due,

principally, to the reduction of blackening. Whereas in ordinary lamps about 55 per cent. of the loss of light with age is due to blackening, with the metallised filament lamps only about 20 per cent. of the loss can be attributed to this cause.

Mr. Willcox also has something to say about the tantalum and tungsten lamps. To the former he attributes a life of 700 to 1,000 hours. The tungsten lamp is no more fragile than the early carbon lamps were, so perhaps this defect will be overcome in time. Tungsten lamps of 25 and 30 volts are in use for train lighting and give satisfaction. The life of tungsten lamps is about 1,000 hours, and the efficiency is 1·25 watts per C.P. They are in use for street lighting, being run in series. The special low voltage lamps for this service are not nearly so fragile as the 110-volt lamps.

Mr. Paul McJunkin discourses upon the Sirius Colloid lamp, which is another name for the Kuzel tungsten lamp. The lamps are being made in three factories in Europe, the joint output being 10,000 lamps daily. One watt per Hefner candle is claimed, and a life of 2,000 hours with a 5 per cent. drop of candle-power has been obtained.

Mr. Otto Foell has something to say about Nernst lamps. The glowers are made of a mixture of zirconium and yttrium oxides. Other substances have also been tried. It is found necessary rigorously to exclude impurities if the best results are to be obtained. One of the most difficult problems to solve was the application of terminals. For alternating current a bead of platinum is fused into the end of the glower. For direct-current service the foregoing terminal is not satisfactory, and a band of platinum wrapped round the glower is preferred. Large current glowers are apt to overheat in the interior, so they are made tubular. The ballast resistance consists of an iron wire at near the temperature of recalescence, immersed in an atmosphere of hydrogen. A slight increase of temperature, due to a slight increase of current, causes a great increase of resistance. Sluggishness must be avoided at any cost, so the lamp housing has to be designed with this end in view. Holophane globes are recommended. It is suggested that lamps should be rated not by their horizontal but by their hemispherical candle-power.

Mr. Percy H. Thomas writes about the mercury vapour lamp—that is to say, about the Cooper-Hewitt pattern of the lamp. The lamp consists of a tube, into which two electrodes are sealed, and containing mercury vapour at low pressure. The spectrum of mercury vapour is not continuous, so that coloured articles appear distorted as to colour if they do not happen to match one or other of the bright bands in the spectrum. The efficiency of the lamp is from $\frac{1}{2}$ to $\frac{3}{4}$ watt per candle. Lamps of 45 in. in length, taking $3\frac{1}{2}$ amperes at 110 volts, give about 700 C.P. With varying voltage the amperes remain practically constant, so that the lamps are almost unaffected by bad pressure regulation, which is a great advantage. Lamps taking currents smaller than 3 or 4 amperes require choking coils in series, otherwise they frequently go out. The choking coil gives out sufficient energy to prevent the circuit actually being broken. Owing to the length of the tube, shadows are reduced, and this is found to be a great practical advantage. The absence of red rays is claimed as an actual advantage to the worker, reducing fatigue to the eyes. The average life of the tubes is between 4,000 and 5,000 hours.

Mr. G. Brewer Griffin takes for his subject "Recent Developments in Metallic Flame Arc Lamps." The electrodes used are metallic oxides, generally called magnetite. These oxides are mixed together and packed into a steel tube, which is then sealed in an electric arc. Titanium oxide renders the flame luminous. Chromium oxide lengthens the life of the electrode. The arc is generally adjusted to 65 to 75 volts, but will burn at 55 if required. The arc is less sensitive to voltage fluctuation than the ordinary carbon arc; 12 in. of electrode will give a life of 175 hours, before requiring retrimming. The colour of the light is uniformly white.

The lower electrode of the lamp is made of convoluted turns of copper and iron, and measures $\frac{1}{2}$ in. in diameter and 1 in. in length. It requires to be renewed when the upper electrode, which burns away, is renewed. The lamp having a downward feed, the arc always occupies the same position. This permits of the accumulation of reddish spongy soot, emanating from the electrode, being removed with precision. This is effected by an ingenious system of air currents, which carry the by-products out of the lamp without permitting them to come into contact with the globe.

Mr. D. McFarlan Moore writes about the Moore tube lighting system, a system which is attracting a great deal of attention just now, and has certainly points to recommend it. Tube lighting approximates to daylight in diffusion, because the area of the lighting source has been multiplied some hundreds of times. The light can be made any colour at will, according to the gas selected for filling the tube. The colour of daylight can be exactly reproduced, which is a matter of importance for artists, drapery stores, &c. The light, too, is perfectly steady, and is practically unaffected by voltage variations. Rooms can be lighted without having an inch of wire brought into them, the tube passing through the walls. The first cost of installation is considerably less than that of an incandescent lighting system, and the tubes last for ever.

Mr. Moore does not give any figures of cost, except that one firm by installing his system is saving $1,300 a year. The system can hardly be compared with other lighting systems on a candle-power basis. As Mr. Moore states, the true basis of comparison should be the mean illumination divided by the watts per square foot of floor space.

The Electrical Production of Steel.—The formation of an electric steel installation company, to which reference was made in a previous issue, has since then taken place in Berlin under the title of the Gesellschaft für Elektrostahlanlagen and under international auspices. As founders are the Eich Hutten Verein, Gallais-Metz & Co., of Dommeldingen, Consul P. Gredt, of Luxemburg, the Metallurgiska Aktiebolaget, of Stockholm, the Rochling Iron and Steel Works, of Volklingen, on the Saar, and the Siemens and Halske Co., of Berlin. The object of the company is the promotion of the industrial utilisation of furnaces for the production of iron, steel and ferro-alloys, and particularly the induction type of furnace of the Kjellin-Rochling-Rodenhauser combination, and to extend the use of the furnaces in all countries other than Great Britain and British colonies, the United States, and Norway and Sweden. The granting of licences in these countries lies in the hands of the Gröndal Kjellin Co., Ltd., of London, the American Electric Furnace Co., Ltd., of New York, and the Metallurgiska Aktiebolaget, of Stockholm. Herr Viktor Engelhardt, of the Berlin Siemens & Halske Co., has been appointed manager of the new company. A second undertaking to which attention may be drawn is that of the steel works of R. Linderberg, at Remscheid, where electrical furnaces on the Héroult-Lindenberg system are in operation. This company has just declared a dividend of 9 per cent. for 1906-7 on a paid up capital of £112,500, as compared with 9 per cent. on £40,000, and 4 per cent. on £25,000, in the preceding year. An exclusive licence for the province of Silesia has been granted to the Bismarck Ironworks, and the starting of various installations on this method will take place in a few months in Austria-Hungary and Switzerland, whilst plant is in course of erection at five steel works in the United States.

An Electric Muffle Furnace.—It is a well-known fact that platinum is the only metal that does not melt readily and still remains useful for electric heating at high temperatures. The initial cost, however, is far too great at the present time to bring this metal within the scope of industrial work. For this reason the development of electric heating where a resistance wire is required, has been much retarded. The difficulty now seems to have been overcome by Hoskins Co., of Chicago, who have discovered a metal whose melting point is well above 1,000° C., and which at this temperature resists the oxidising power of the air. The wire has a resistance six times as great as platinum, a circumstance which renders the use of a rheostat unnecessary. This new discovery has been utilised in the construction of a new form of muffle furnace (*Electrochemical and Metallurgical Industry*, Vol. V, No. 10), which will probably be seen in the near future in many laboratories. As all the resistance wire is wound in the furnace itself, the entire electrical energy is converted into useful heat, none being lost in an external rheostat, and consequently the greatest economy is effected. The furnace can be operated on the ordinary 110-volt electric light circuit, with either alternating or direct current for the smaller sizes of apparatus. The same company is about to put on the market a special resistance furnace for alternating currents only, that will melt anything from lead to platinum. This latter very useful type of small scale furnace will have a capacity up to 100 lb. of metal. The price is low, and for that reason will probably find favour in many quarters.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

3,000A. "Improvements in or relating to electrolytic apparatus." A. J. Boult. (Elektricitäts Akt.-Ges. vormals Schuckert & Co., Germany.) (Date applied for under Rule 5 of the Patents Rules, 1905, February 6th, 1907.) October 8th. (Complete.)

22,911A/06. "Method and means for sealing electric conductors in or through glass or like vitreous material." C. O. Bastian and G. Calvert. (Date applied for under Rule 5 of the Patents Rules, 1905, October 16th, 1906.) October 11th.

26,212A/06. "Improvements in or connected with anodes for electro-deposition." S. O. Cowper-Coles. (Date applied for under Rule 5 of the Patents Rules, 1905, November 19th, 1906.) October 11th.

26,212B/06. "Improvements in or connected with anodes for electro-deposition." S. O. Cowper-Coles. (Date applied for under Rule 5 of the Patents Rules, 1905, November 19th, 1906.) October 11th.

26,212C/06. "Improvements in or connected with anodes for electro-deposition." S. O. Cowper-Coles. (Date applied for under Rule 5 of the Patents Rules, 1905, November 19th, 1906.) October 11th.

22,054. "Protecting or shrouding devices for use on metallic standards or uprights of electric tramway schemes." J. Collier. October 7th.

22,057. "Improvements in or relating to flexible connecting cords for telephone and telegraph switchboards." L. Robinson. October 7th.

22,082. "Improvements in or relating to ignition systems comprising multiple induction coils with separate trembler or tremblers." S. J. Watson and G. H. Smith. October 7th.

22,083. "Reversible commutator cam." A. P. L. Boulanger and G. H Smith. October 7th.

22,085. "Improvements in and relating to electric batteries." K. Schwarzwalder. October 7th. (Complete.)

22,117. "Improvements in and relating to secondary batteries." J. Stone and Co., Ltd., and E. M. Preston. October 7th.

22,131. "Improvements in and relating to the control of electric motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) October 7th.

22,140. "Spring electrical appliances." H. Ashton. October 8th.

22,151. "Improvements in electric signalling on railways." W. Cohen. October 8th.

22,168. "Improvements in and relating to electric measurements on alternating current circuits." C. C. Garrard and Ferranti, Ltd. October 8th.

22,194. "Improvements relating to electric switches." J. Kiell and A. A. Stow. October 8th.

22,202. "Improvements in insulating material." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 8th.

22,203. "Improvements in and relating to the control of electric motors." British Thomson-Houston Co., Ltd. (Allgemeine-Elektricitäts Ges., Germany.) October 8th.

22,211. "Improvements in and relating to secondary batteries." E. L. Oppermann. October 8th.

22,224. "Improved device for call or indicator flaps." H. Zander. (R. Held, Germany.) October 8th. (Complete.)

22,248. "Improvements in or connected with thermo-electric alarm apparatus." J. Propert. October 9th.

22,259. "Improvements in electric locks." J. C. Etchells. October 9th. (Complete.)

22,283. "Electric furnace for the continuous extraction of zinc from its ores." E. F. Cote and P. R. Pierron. October 9th.

22,285. "Improvement in the construction of dynamo-electric machinery and in the method of suspending same." H. C. C. C. Silver. October 9th.

22,301. "Improvements in current-collecting devices for dynamo-electric machines." J. E. Noeggerath. (Date applied for under Patents Act, 1901, October 10th, 1906, being date of application in United States.) October 9th. (Complete.)

22,302. "Improvements in methods of neutralising induction from alternating electric current systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 9th.

22,311. "Improvements in the electro-deposition of iron." S. O. Cowper-Coles. October 9th.

22,312. "Improvements in the manufacture of iron articles by electro-deposition." S. O. Cowper-Coles. October 9th.

22,317. "Electric and aseptic mouth gag and dental searchlight." D. G. G. Macdonald. October 10th.

22,330. "Improvements in ships' telegraphs." A. Davie. (R. Dussich, Austria.) October 10th.

22,349. "Improvements in electric switches or controllers." J. C. Etchells. October 10th. (Complete.)

22,404. "Improvements in and relating to dynamo-electric machines." Allgemeine Elektricitats Gesellschaft. (Date applied for under Patents Act, 1901, October 22nd, 1906, being date of application in Germany.) October 10th. (Complete.)

22,405. "Improvements in systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 10th.

22,446. "Improvements in telephonic apparatus or in connection therewith." S. Marsh. October 11th.

22,457. "Improved means of electrically-connecting dynamo-electric machines with their supply or distributing circuits." E. M. Duncan. October 11th.

22,467. "Improvements in and relating to transformers for electric current." F. M. E. Pinot. (Date applied for under Patents Act, 1901, November 9th, 1906, being date of application in France.) October 11th. (Complete.)

22,473. "Improvements in or relating to electric ships' logs." E. V. H. Rizzo. October 11th.

22,475. "Improvements in insulating rollers for cables, wires or the like." W. P. Thompson. (G. Schanzenbach & Co., Kommandit-Gesellschaft, Germany.) October 11th.

22,478. "Improvements in or relating to electrical resistance devices for the control of electric energy, telephone transmitters, coherers and the like, and mechanical dampers for vibration." H. S. Martin. October 11th.

22,481. "Improvements in and relating to the control of electric motors." Allgemeine Elektricitats Gesellschaft. (Date applied for under Patents Act, 1901, October 18th, 1906, being date of application in Germany). October 11th. (Complete.)

22,503. "Improved electric radiant heat bath." W. N. Probert and H. H. Jackson. October 12th.

22,523. "Improvements in magnetic separators for separating tin, iron and other metals from destructor or other refuse." G. T. Meek. October 12th.

22,526. "Improvements in alternating-current electric motors." H. C. E Jacoby. October 12th.

22,527. "Improvements in alternating-current electric motors." H. C. E. Jacoby. October 12th.

22,543. "Improvements in and relating to anodes for electro-deposition." S. O. Cowper-Coles. October 12th. (Complete.)

22,547. "Improvements in or relating to electrical heating of metals and other substances, and to apparatus therefor." A. E. Bourcoud. October 12th.

22,549. "Improvements in bases for electrical switches or appliances." H. W. Cox. October 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool price, post free, 9d. (in stamps).

1906.

Electrical Speed and Distance Indicators for Wheeled Vehicles. E. I. Everett and K. Edgcumbe. 21,543. September 29th.

Treatment of Refractory Materials by Means of the Electric Arc and Apparatus Therefor. British Thomson-Houston Co. (General Electric Co., United States.) 21,667. October 1st.

Process for Rendering Fabric Opaque to Rontgen Rays. M. Meisel. 22,796. October 15th.

Dynamo-Electric Machines. H. A. Jones, R. Pohl and the Phœnix Dynamo Manufacturing Co. 22,981. October 17th.

Portable Telephone and Telegraph Apparatus. W. A. W. E. Hjorth, C. E. Ljungman and R. O. P. Berglund. 23,002. October 17th.

Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co., United States.) 23,010. October 17th.

Overhead Electric Traction Gear. J. Sayers. 23,040. October 18th.

Electric Switches. W. G. Haywood. 23,308. October 20th.

Protective Devices for Electric Apparatus. British Thomson-Houston Co. (General Electric Co., United States.) 24,446. November 1st.

Means for Regulating Electric Arc Lamps. Clarke, Chapman & Co. and G. W. Money. 25,413. November 10th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co., United States.) 25,753. November 14th.

Holders for Electric Incandescent Lamps. P. Muller. 28,395. December 12th.

1907.

Electrical Transmission of Time. G. H. R. M. de Peyrecave and L. F. M. de Peyrecave. 502. January 8th.

Incandescent Electric Lamps. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 814. January 11th.

Means for Compounding and Regulating Direct-Current Dynamo-Electric Machines. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 575. January 14th. (Date applied for under International Convention, January 13th, 1906.)

Alternating-Current Commutator Electric Motors for Increasing the Starting Torque Thereof. Felten & Guilleaume Lahmeyerwerke Akt.-Ges.) 2,677. February 2nd. (Date applied for under International Convention, February 3rd, 1906.)

Regulating Arrangements for Electrically-Driven Hoisting or Winding Engine Installations. Felten & Guilleaume Lahmeyerwerke Akt.-Ges.) 8,809. February 15th. (Date applied for under International Convention, February 15th, 1906.)

Method of Charging Electric Furnaces for Producing Carbide from Lime and Carbon. A. Petersson. 5,657. March 8th.

Electric Motor Controlling Devices. Allgemeine Elektricitäts Ges. 8,948. April 17th. (Date applied for under International Convention, April 18th, 1906.)

Arc Lamps. J. P. Gallois. 10,040. April 30th. (Date applied for under International Convention, May 2nd, 1906.)

Method of Fastening Metallic Filaments to Electric Glow Lamps. H. J. Haddan. (Bergmann Elektricitätswerke Akt.-Ges.) 11,178. May 30th.

Process for the Prevention of the Denitrating Action in the Gay Lussac Absorption Apparatus. H. Petersen. 11,559. May 17th.

The Use of Repulsion Motors for Yarn Spinning.

—The motor employed by Messrs. Brown, Boveri & Co. for this somewhat delicate work, is of the repulsion type fitted with Deri's arrangement of brushes (see fig.). The necessary speed variation (20 per cent. to 30 per cent.) is attained by moving the brushes b_1 b_2 towards or away from the fixed brushes f_1 f_2. When f_1 and b_1 are in line and also f_2 and b_2, no torque is developed, and the motor

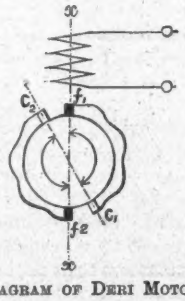


Diagram of Deri Motor.

remains at rest. The further the brushes are apart the greater is the torque until it reaches a maximum with the brushes at about 160° (the pole-pitch being represented by 180°). A 10-H.P. six-pole 500-volt 50-cycle motor of this type has a maximum efficiency of 85 per cent., a power factor of ·89 and a starting torque which is $2\frac{1}{2}$ times the normal. The motors are usually totally enclosed and arranged with leading-in and leading-out pipes for the necessary cooling air.—*Elektrotechnik und Maschinenbau.*